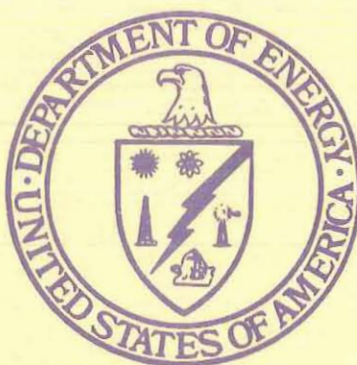


Final Environmental Impact Statement

**REMEDIAL ACTIONS AT THE FORMER
VITRO CHEMICAL COMPANY SITE
SOUTH SALT LAKE, SALT LAKE COUNTY
UTAH**

VOLUME I - TEXT



July, 1984

U.S. DEPARTMENT OF ENERGY

Cover Sheet

Final Environmental Impact Statement

Remedial Actions at the

Former Vitro Chemical Company Site

South Salt Lake, Salt Lake County

Utah

- (a) Lead Agency: U.S. Department of Energy (DOE)
Cooperating Agency: U.S. Nuclear Regulatory Commission (NRC)
 - (b) Proposed Action: Relocation of the residual radioactive materials from the former Vitro Chemical Company site, South Salt Lake, Utah, for long-term stabilization and control at the South Clive site near Clive, Utah, under the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604).
 - (c) For Further Information Contact: (1) Mr. James A. Morley, Project Manager, Uranium Mill Tailings Remedial Action Project, U.S. Department of Energy, Albuquerque Operations Office, 5301 Central Avenue, N.E., Suite 1700, Albuquerque, New Mexico 87108, Ph: (505) 844-3941; (2) Dr. Robert J. Stern, Director, Office of Environmental Compliance, U.S. Department of Energy, Office of the Assistant Secretary for Policy, Safety, and Environment, Room 4G-085, Forrestal Building, 1000 Independence Avenue, S.W., Washington, DC 20585, Ph: (202) 252-4600; (3) Mr. Henry Garson, Esq., Assistant General Counsel for Environment, U.S. Department of Energy, Room 6D-033, Forrestal Building, 1000 Independence Avenue, S.W., Washington, DC 20585, Ph: (202) 252-6947.
- For Copies of the FEIS, Contact: Project Manager at the above address.
- (d) Designation: Final EIS (FEIS).
 - (e) Abstract: This statement evaluates the environmental impacts associated with the cleanup of those residues remaining at the abandoned uranium-mill-tailings site located in South Salt Lake, Utah, and hereinafter called the Vitro site. The site is a 128-acre property owned by the Central Valley Water Reclamation Facility (CVWRF) Board which also operates a sewage treatment plant adjacent to the northern boundaries of the Vitro site. The site contains approximately 2.5 million cubic yards of contaminated residues and soil; the residues were produced by the Vitro Chemical Company of America which processed uranium ore for sale to the U.S. Atomic Energy Commission on the site from 1951 to 1964.

This statement evaluates three alternatives for minimizing the public health hazards associated with the Vitro site contaminated materials: (1) no action; (2) stabilization of the contaminated material on the Vitro site; and (3) decontamination of the Vitro site and disposal of the contaminated material at a site located about one mile south of Clive, Utah.

Alternative 3 is DOE's preferred alternative.

An assessment of the impacts of these three alternatives was made in terms of effects on radiation levels, air quality, soils and mineral resources, surface- and ground-water resources, ecosystems, land use, sound levels, historical and cultural resources, populations and employment, economic structures, and transportation networks.

The main impact of Alternative 1 is the 0.2 excess cancer death per year predicted for the Salt Lake Valley population from the above-background levels of radon emitted by the Vitro site. Implementation of Alternatives 2 or 3 would reduce the existing radon levels after remedial action to near background levels and essentially eliminate the potential for incremental cancer deaths.

Another impact of Alternative 1 is the inhibition of an ongoing expansion of the CVWRF sewage-treatment plant to a capacity of 100 million gallons per day by the year 2000; the CVWRF Board requires land in the northern half of the 128-acre Vitro site to complete this expansion. The implementation of Alternative 2 would allow the CVWRF Board to use 60 percent of the site; implementation of Alternative 3 would release 100 percent of the site for CVWRF Board use.

A third major concern of implementing either Alternatives 2 or 3 is ground-water protection. After remedial action of Alternative 2, ground-water systems would be protected by a liner system that would retard movement of contaminants for a long period of time. Implementation of Alternative 3 would eliminate any future possibility of additional contamination of ground waters beneath the site.

The major impacts of Alternative 2 during the remedial action include: 0.3 expected excess cancer death among the general public; 0.02 expected cancer death and 0.15 expected death by occupational accidents among the remedial-action workers; the importation by truck of about 1.9 million cubic yards of soil, clay, and rock to the Vitro site; and the use of 0.4 million kilowatt-hours of electricity and 2.5 million gallons of engine fuel.

The major impacts of Alternative 3 during the remedial action include: 0.3 expected excess cancer death among the general public; 0.05 expected cancer death and 0.14 (train) or 0.52 (truck) expected death by occupational accidents among the remedial-action workers; the permanent use of 60 acres of Utah State lands at the site south of Clive; the importation of about 1.0 million cubic yards of soil to the Vitro site and 244 thousand cubic yards of rock to the site south of Clive; and the use of 800,000 kilowatt hours of electricity (train or truck) and 7 million gallons of engine fuel (train or truck).

This FEIS contains several changes from the Draft Environmental Impact Statement (DEIS) issued by the DOE in January 1983. These changes include the following:

1. Use of the final U.S. Environmental Protection Agency (EPA) standards (40 CFR 192) in place of the proposed EPA standards (40 CFR 192 proposed).
2. Revision of the ground-water discussions to include new data and current modeling results (Appendix D). Wells were drilled upgradient and downgradient of the site, in the upper unconfined and deeper confined ground-water systems. Samples were collected for analysis and field tests (e.g., pump tests) were conducted.
3. Revision of Appendix A to reflect the most recent engineering designs. For Alternative 2, the embankment has been relocated from the southwest portion of the site (as described in the DEIS) to the southeast, and the tailings would be underlain by a liner system. For Alternative 3, rather than a series of trenches spread over a large area, a 60-acre embankment (partially below grade) would be constructed.
4. Addition of a new Appendix H that assesses seismic impacts.
5. Addition of a new Appendix I that assesses land value impacts.
6. Addition of a new chapter containing public comments on the DEIS and the DOE's responses to these comments.
7. Modification (scaling) of impacts in response to design revisions.
8. The consideration of transporting tailings to South Clive by truck.
9. Revision of Appendix F to reflect the most recent engineering designs, and the most recent radiological data.
10. The identification of Alternative 3 as the DOE's preferred alternative.

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TABLE OF CONTENTS

	<u>Page</u>
1 SUMMARY	1
1.1 Background	1
1.2 Description of alternatives	4
1.2.1 Alternative 1 - no action	4
1.2.2 Alternative 2 - stabilization at the Vitro site	9
1.2.3 Alternative 3 - decontamination of the Vitro site and disposal of the Vitro material at South Clive	10
1.3 The affected environment	10
1.4 Environmental impacts	12
1.5 Remedial actions.	16
1.6 Maintenance and monitoring.	16
2 PURPOSE AND NEED	19
2.1 Introduction	19
2.2 Purpose and need	19
References for Chapter 2	23
3 ALTERNATIVES FOR THE REMEDIAL ACTION	25
3.1 Introduction	25
3.1.1 EPA standards	25
3.1.2 NRC concurrence	29
3.2 Description of the alternatives	29
3.2.1 Background	29
3.2.2 Alternative 1 -- no action	33
3.2.3 Alternative 2 -- stabilization on the Vitro site . . .	33
3.2.4 Alternative 3 (proposed action) -- Decontamination of the Vitro site and stabilization at the South Clive site	37
3.2.5 Alternatives eliminated from further consideration . .	48
3.2.5.1 Stabilization at other state-nominated locations	48
3.2.5.2 Stabilization in eastern Utah	49
3.2.5.3 Stabilization at other locations in Salt Lake Valley	49
3.2.5.4 Reprocessing of the Vitro tailings	49
3.3 Environmental impacts	50
3.3.1 Comparison of impacts	50
3.3.2 Mitigating measures	52
3.3.3 Summary of major impacts	53
References for Chapter 3	55
4 AFFECTED ENVIRONMENT	57
4.1 Regional setting	57
4.2 Description of the affected areas	57
4.2.1 The Vitro site and surroundings	59
4.2.1.1 The 5.4-acre industrial tract	59
4.2.2 The South Clive site and surroundings	59
4.2.3 The transportation corridors.	60

TABLE OF CONTENTS (Continued)

	<u>Page</u>
4.3 Climate	60
4.3.1 Weather patterns	60
4.3.2 Temperature	61
4.3.3 Precipitation	61
4.3.4 Winds	62
4.3.5 Storms	62
4.4 Air quality	63
4.5 Surface and subsurface features	63
4.5.1 Physiography and topography	64
4.5.2 Geologic features	64
4.5.3 Mineral resources	66
4.5.4 Seismic hazard.	66
4.6 Water	72
4.6.1 Surface water	72
4.6.2 Ground water	79
4.7 Ecosystems	91
4.7.1 Soils	86
4.7.2 Vegetation	88
4.7.3 Terrestrial wildlife	90
4.7.4 Aquatic biota	90
4.7.5 Endangered and threatened species	90
4.8 Radiation	85
4.8.1 Vitro site	91
4.8.2 The South Clive site	92
4.8.3 The transportation corridor	95
4.9 Land use	95
4.9.1 Vitro site	96
4.9.2 South Clive site	99
4.10 Ambient sound levels	100
4.11 Scenic, historical, and cultural resources	102
4.11.1 History	102
4.11.2 Scenic qualities	102
4.11.3 Places of archaeological, historical, or cultural significance	103
4.12 Socioeconomic characteristics	104
4.12.1 Populations	104
4.12.2 Economic structures	106
4.12.3 Governmental structures	107
4.12.4 Housing	107
4.12.5 Community services	107
4.12.6 Transportation networks	109
4.12.7 Recreation	110
4.12.8 Public concerns regarding the remedial action project	112
References for Chapter 4	113

TABLE OF CONTENTS (Continued)

	<u>Page</u>
5 ENVIRONMENTAL CONSEQUENCES	119
5.1 Radiological impacts	119
5.1.1 Introduction	119
5.1.2 Exposure pathways	119
5.1.3 Methods of impact assessment	121
5.1.4 Radiological impacts	122
5.1.5 Radiological impacts of transportation accidents . . .	124
5.1.6 Comparison of Rn-222 emissions with EPA standards	127
5.2 Impacts on air quality	127
5.3 Impacts on topography, soils, and mineral resources	131
5.3.1 Impact on topography	131
5.3.2 Impacts on soils	131
5.3.3 Impacts on mineral resources	132
5.3.4 Longevity of conceptual designs against wind erosion, water erosion, and earthquakes	132
5.4 Impacts on water	134
5.4.1 Impacts on surface waters	134
5.4.2 Impacts on ground waters	135
5.5 Impacts on ecosystems	139
5.6 Impacts on land use	139
5.7 Impacts on sound levels	141
5.8 Impacts on scenic, historical, and cultural resources	144
5.9 Impacts on populations and employment	145
5.10 Impacts on housing, community services, and social structures	147
5.11 Impacts on economic structure	148
5.12 Impacts on transportation networks	150
5.13 Use of energy and other resources	153
5.14 Nonradiological impacts of accidents.	154
5.15 Relationship to land use plans, policies, and controls	155
5.16 Unavoidable adverse impacts	156
5.17 Irreversible and irretrievable commitments of resources	157
5.18 Relationship between the short-term use of the environment and the maintenance and enhancement of long-term productivity	157
5.19 Mitigation measures during the remedial actions	158
5.19.1 Mitigation of impacts on land use	158
5.19.2 Mitigation of impacts of releases of radiation	158
5.19.3 Mitigation of impacts on water	159
5.19.4 Mitigation of impacts on noise.	159
5.19.5 Mitigation of impacts on transportation networks. . . .	159
5.19.6 Mitigation of impacts from seismic events	159
References for Chapter 5.	161

Table of Contents

	<u>Page</u>
6 PUBLIC AND AGENCY COMMENTS.	163
6.1 Compliance with NEPA	164
6.2 EPA and other regulations.	165
6.3 NRC and state concurrence.	169
6.4 Schedule	169
6.5 Alternatives	171
6.6 The geologic and hydrologic suitability of the Vitro site. . .	174
6.7 The geologic and hydrologic suitability of the South Clive site.	179
6.8 The seismic suitability of the Vitro and South Clive sites . .	182
6.9 Engineering designs.	187
6.10 Costs, direct and indirect	198
6.11 Radiological exposures and effects	204
6.12 Health effects and conversion factors.	208
6.13 Land use	210
6.14 Nonradiological impacts.	214
6.15 Psychological impacts.	216
6.16 Maintenance and monitoring	217
6.17 Mitigation measures.	218
6.18 Archaeology.	221
6.19 Editorial comments	221
6.20 Out of scope comments.	223
6.20.1 Personal preferences	223
6.20.2 Bias	224
6.20.3 State standards and licensing.	225
6.20.4 Public participation	225
6.20.5 Private profit	226
6.20.6 Proper use of taxpayers' money	226
6.20.7 Decision-making process.	227
6.20.8 Manner of response	228
6.20.9 Other.	228
6.21 Letters received during the comment period.	235
References for Chapter 6	
Glossary	
List of acronyms	
List of preparers of this statement	
Index	

TABLE OF CONTENTS (Continued)

Appendix A	Site conceptual design
Appendix B	The selection of an off-site disposal site
Appendix C	Alternatives that were considered but rejected
Appendix D	Hydrological and water-quality information
Appendix E	Socioeconomic information
Appendix F	Radiological information
Appendix G	Miscellaneous information and calculations
Appendix H	Seismic information
Appendix I	Economic impact of remedial action, alternative 2
Appendix J	List of agencies, organizations, and persons receiving copies of this statement

LIST OF FIGURES

	<u>Page</u>
1-1 General Vitro site area	2
1-2 Site conditions--Vitro site	3
1-3 Location of state-nominated alternate sites	5
3-1 Location map of the Salt Lake City site, South Salt Lake City, Utah	30
3-2 Map of Salt Lake City site showing major areas.	31
3-3 Plot plan showing the stabilized pile, South Salt Lake site	34
3-4 Typical liner and embankment section, South Salt Lake site.	39
3-5 South Clive vicinity map.	40
3-6 Plot plan, Vitro site	42
3-7 Plot plan for South Clive.	43
3-8 Typical section of the embankment, South Clive site	47
4-1 Earthquake epicenters within a 200-mile radius of the Vitro site. .	70
4-2 Earthquake epicenters within a 200-mile radius of the South Clive site.	71
4-3 Surface drainage patterns	73
4-4 South Clive watersheds.	76
4-5 Locations of water quality sampling stations.	78
4-6 Generalized ground-water hydrogeology for the southern Salt Lake City area	81
4-7 Potentiometric surface map of the confined (artesian) aquifer for the southern Salt Lake area	82
4-8 Vegetation map of the South Clive site and vicinity	89
4-9 Locations of radiological monitoring stations	93
4-10 CVWRF proposed site development	98
4-11 Transportation routes and traffic volumes	111
5-1 Potential radiation exposure pathways to the general public and remedial-action workers	120
5-2 Trace metal concentrations after remedial action.	137

LIST OF TABLES

	<u>Page</u>
1-1 Summary of specific actions associated with alternatives.	6
1-2 Estimated quantities and other pertinent data associated with remedial action operations	7
1-3 Comparison of the impacts of the alternatives	13
1-4 Document publication schedule - Salt Lake City remedial action project.	17
3-1 EPA Standards	26
3-2 Contaminated materials on Vitro site.	32
3-3 Material volumes, stabilization on the Vitro site	38
3-4 Material volumes, relocation to South clive	46
4-1 Largest earthquakes in the Utah region, 1850 through 1978	68
4-2 Physical-chemical properties of soils of the South Clive site and vicinity	87
4-3 Land use and ownership for Tooele County, 1970, and Salt Lake County, 1976.	96
4-4 Typical values of day-night sound levels, L_{dn}	101
4-5 Population wheel for South Clive site	105
4-6 Current and projected average daily traffic along the haul route.	109
5-1 Estimates of 3-year excess population dose equivalent commitments to the general public during remedial action, and expected excess cancer deaths caused by remedial action (based on a 3-year period for each alternative)	123
5-2 Estimates of excess collective dose commitments to the remedial action workers and expected excess cancer deaths caused by remedial action	125
5-3 Background radiological levels and EPA limits	126
5-4 Estimated fugitive dust concentrations and National Ambient Air Quality Standards	128
5-5 Fugitive dust impacts, Alternative 3.	130
5-6 Materials that must be imported to Vitro site	132

LIST OF TABLES

	<u>Page</u>
5-7 Equipment noise emissions and use factors	142
5-8 Estimated operation ambient sound levels	142
5-9 Alternative 3 noise emission projections (dBA @ 500 feet)	143
5-10 Current, projected, and projected with remedial action average daily traffic along the haul route; Alternative 2.. . . .	152
5-11 Energy and other resource requirements	154
5-12 Expected number of work-related accidents	155
6-1 Index of commenters at the DEIS hearings.	229
6-2 Index of persons submitting written comments.	231
6-3 Cross-index of commentors and issues.	232

1 SUMMARY

1.1 BACKGROUND

The Vitro site is a 128-acre property 4 miles south-southwest of the center of Salt Lake City, Utah, in the city of South Salt Lake (Figures 1-1 and 1-2). The entire site is owned by Central Valley Water Reclamation Facility (CVWRF) Board, which operates waste-water treatment plant No. 1 on adjacent property north of the central portion of the Vitro site.

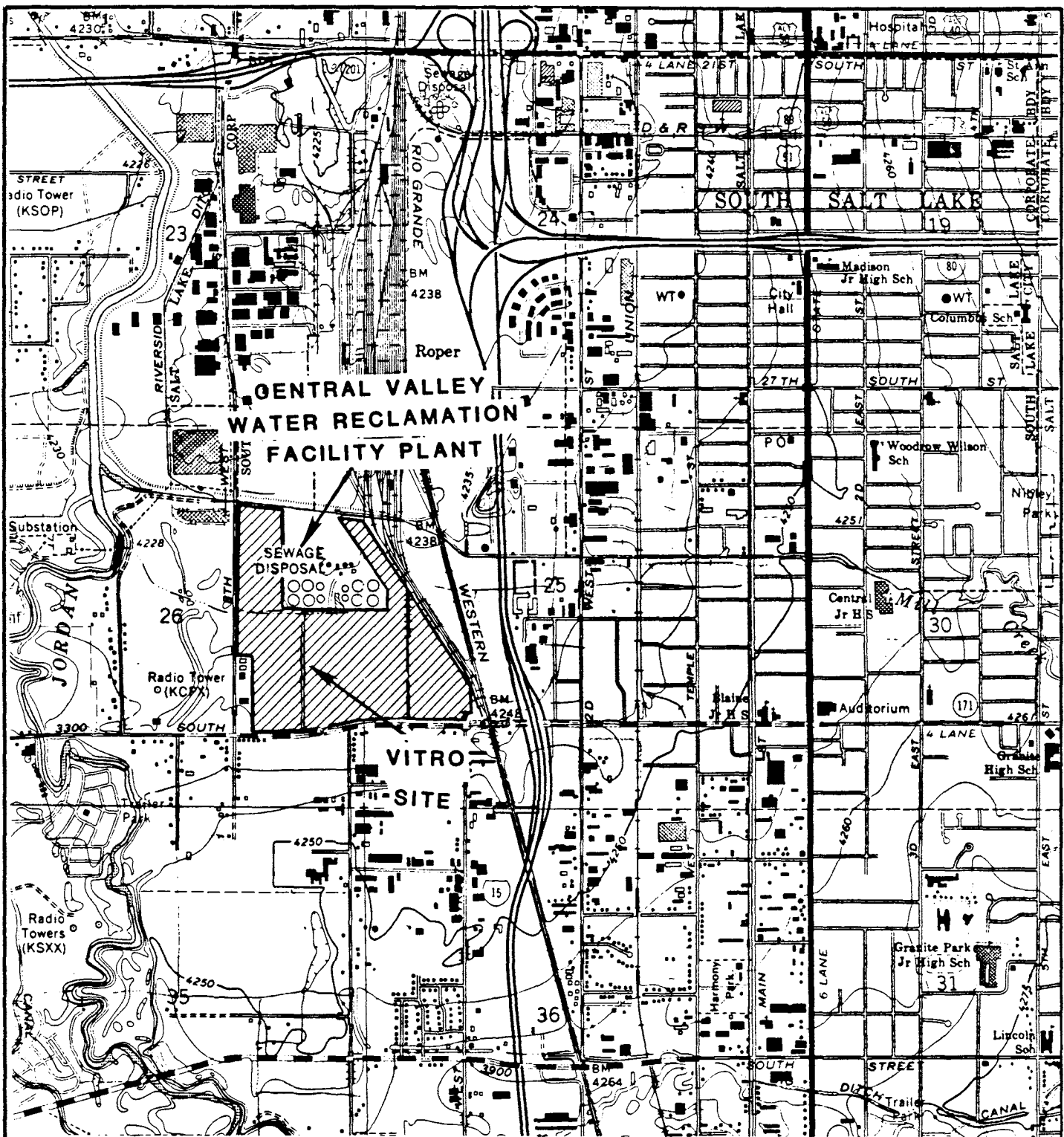
The site is bounded on the north by the CVWRF plant and Mill Creek, on the east by the tracks of the Denver and Rio Grande Western Railroad, on the south by 3300 South Street, and on the west by 900 West Street. An industrial area occupies a 225-foot wide, 5.4-acre strip along the west edge of the south half of the site facing 900 West Street.

From 1951 to 1964 the Vitro Chemical Company of America processed uranium ore for sale to the U.S. Atomic Energy Commission at a mill in the southeast corner of the site. When the plant was dismantled in 1970, the radioactively-contaminated materials from the processing operations (approximately 1.9 million dry tons of uranium mill tailings and over 1 million dry tons of other contaminated material) remained on the site piled as high as 16 feet in some spots. Over the years some of the tailings were removed for use in construction projects elsewhere in the Salt Lake City area. It is estimated that about 100 off-site properties contain contaminated materials from these construction projects; the bulk of the tailings, however, remain at the Vitro site.

In 1978, Congress passed Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), having expressly found that uranium mill tailings may pose a potential health hazard to the public. The Environmental Protection Agency (EPA) was charged with the responsibility for promulgating radiological and nonradiological standards for remedial action at inactive millsites. The Department of Energy (DOE) was authorized to enter into cooperative agreements with affected states or Indian tribal governments to perform remedial actions to bring the radiation levels at sites under their jurisdiction within the EPA standards. All remedial actions were to be performed with the concurrence of the Nuclear Regulatory Commission (NRC), which, at the conclusion of the remedial action, would issue a license for long-term maintenance and surveillance of disposal sites.

On November 8, 1979, the DOE designated the Vitro site as eligible for remedial action under UMTRCA. The DOE and the State of Utah entered into a cooperative agreement effective January 30, 1981, to perform remedial action on this site. During summer 1984, the cooperative agreement will be modified to designate the State of Utah as the party to perform remedial actions on the uranium mill tailings and to reflect changes to the agreement that result from this designation.

In 1980, the State of Utah evaluated a number of potential off-site disposal areas that could be used if the Vitro site were to be cleaned up and

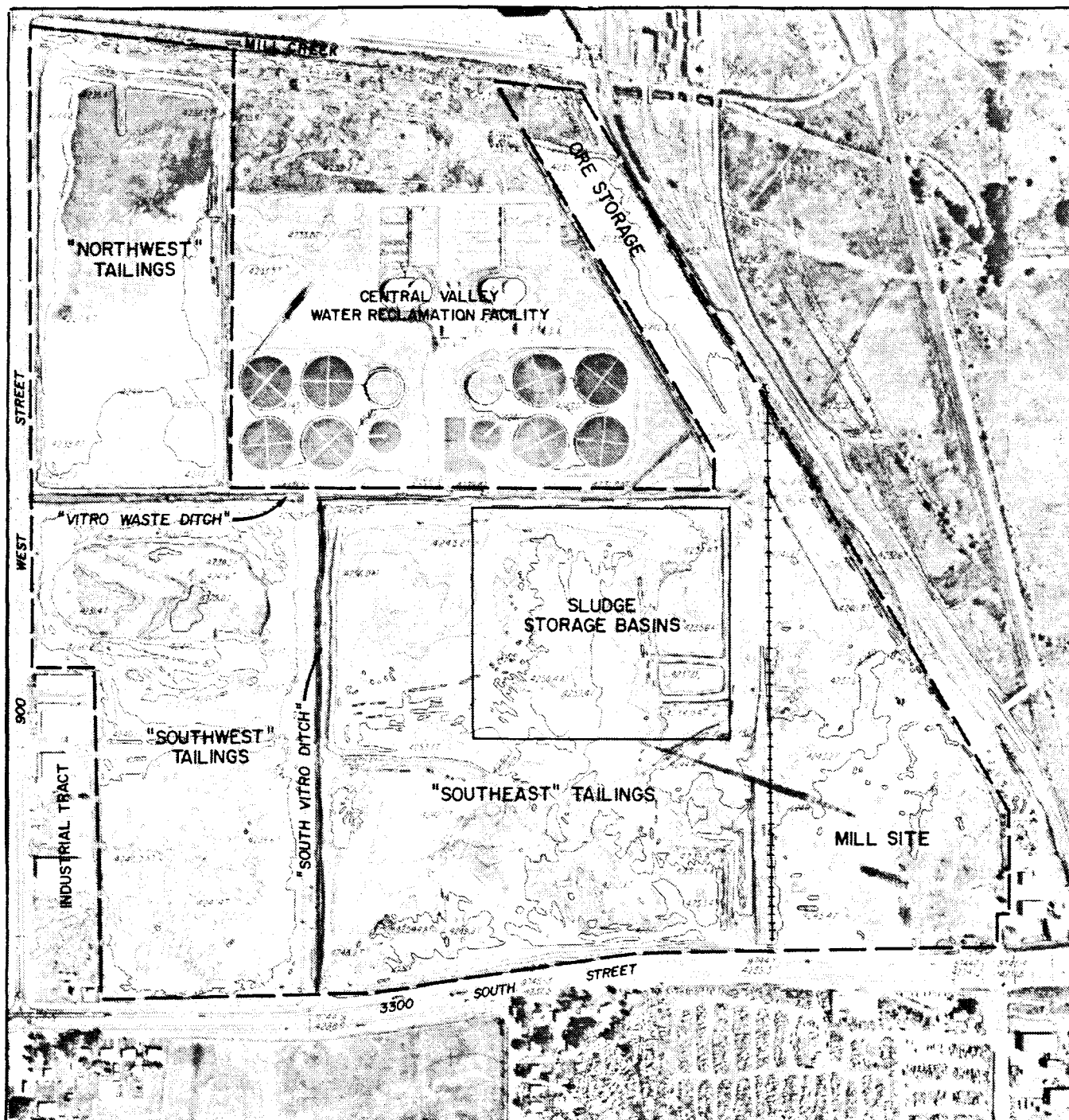


0 1000 2000 3000 FEET

SCALE

BASE MAP REFERENCE: USGS 7 1/2 - MINUTE TOPOGRAPHIC
QUADRANGLE MAP, "SALT LAKE CITY SOUTH, UTAH"
DATED 1963 (PHOTOREVISED 1969 AND 1975).

FIGURE 1-1
GENERAL VITRO SITE AREA.



BASE MAP REFERENCES:

AIRPHOTO FROM FORD, BACON & DAVIS UTAH INC.,
 DATE UNKNOWN. OUTLINE OF PROPOSED EXPANSION
 BY COON, KING AND KNOWLTON ENGINEERS, SALT
 LAKE CITY, UTAH.

0 250 500 1000 FEET
 SCALE



FIGURE 1-2. SITE CONDITIONS - VITRO SITE.

contaminated materials moved elsewhere. Utah nominated three sites to the DOE, all of which are in Tooele County west of Salt Lake City (Figure 1-3). The DOE made an independent evaluation of these and picked a site hereinafter called the South Clive site as the best of the three because of its environmental and geotechnical superiority. It is 85 road or rail miles west of the Vitro site on the eastern edge of the Great Salt Lake Desert and is owned by the State of Utah.

1.2 DESCRIPTION OF ALTERNATIVES

Three alternatives have been evaluated for remedial actions at the former Vitro Chemical Company site. They are as follows:

1. No action.
2. Stabilization of the contaminated material at the Vitro site.
3. Decontamination of the Vitro site and disposal of the contaminated material at the South Clive site.

The specific actions associated with these alternatives are outlined in Table 1-1. The material handling and resource volumes, manpower, and duration for each alternative are listed in Table 1-2.

Several other alternatives are not considered in this document since the DOE determined that they would not represent reasonable alternatives. These are stabilization at other state-nominated locations (because, as noted above, they are less desirable than the South Clive site), stabilization at two much more remote sites in Utah (because their distance makes them less cost-effective with no compensating benefits), stabilization at other locations in Salt Lake Valley (because these offer no clear advantages economically or environmentally over stabilization in place).

Title I of UMTRCA directs the DOE to consider the practicability of reprocessing the tailings in designated inactive uranium mill tailings sites in order to recover their residual uranium and other mineral values. Pursuant to that law, the DOE sought expressions of interest in reprocessing by notices in the Federal Register, in the Commerce Business Daily, and in a public press release. Several expressions of general interest were received, but none specific to the Vitro tailings. The DOE has completed detailed assays of Vitro and other tailings to follow up on these expressions of interest. However, the results of these assays indicate that reprocessing of the Vitro tailings is not economic at present-day prices for uranium. Therefore, the reprocessing alternative has been considered by the DOE as not being a reasonable alternative for purposes of this document.

1.2.1 Alternative 1 - no action

This alternative would consist of performing no remedial action, thereby allowing the present situation at the Vitro site to continue.

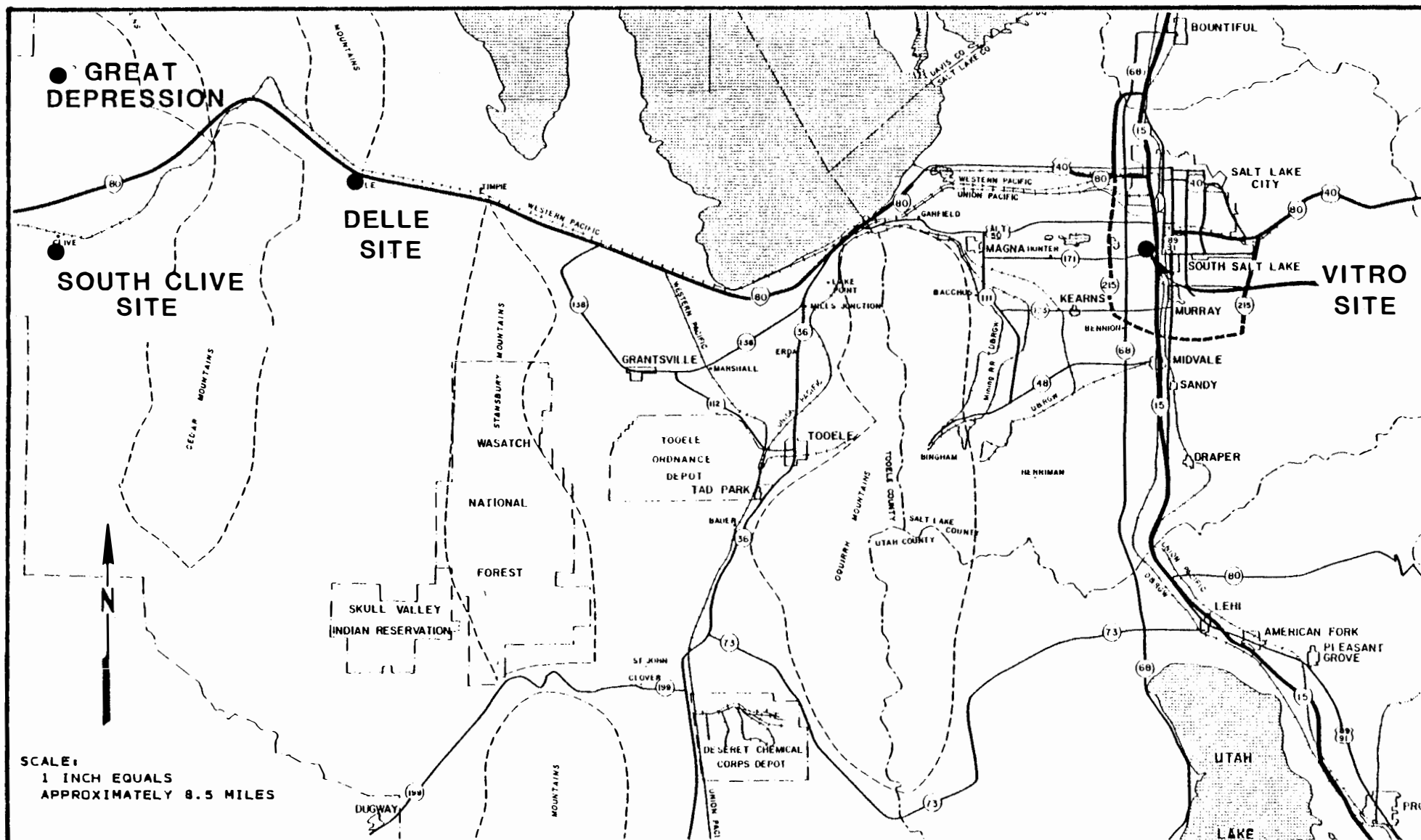


FIGURE 1-3 LOCATION OF STATE-NOMINATED ALTERNATE SITES

Table 1-1. Summary of specific actions associated with alternatives

Alternative 1. No Action:

1. No remedial action would be taken.
2. No monetary cost would be incurred.

Alternative 2. Stabilization on the Vitro site:^a

1. Preparation of 53-acre embankment area, including liner system.
2. Conveyance of contaminated material to a 53-acre embankment area, creating a 45-foot-high mound prior to covering.
3. Restoration of outlying areas within the Vitro site from which contaminated materials were excavated by placing imported soils to original grade.
4. Cover contaminated materials with 3 feet of radon barrier soils and 1 to 2 feet of pit run rock.
5. Estimated total cost: \$31.2 million.^a

Alternative 3. Decontamination at Vitro site; stabilization of material south of Clive:

1. Excavation and conveyance of contaminated material to a stockpile area on Vitro site (train option).
2. Preparation of railroad track "spurs" at South Clive and Vitro sites; preparation of roads near South Clive site.
3. Transportation of contaminated material and rubble by unit trains or trucks to South Clive site.
4. Restoration of excavated areas at Vitro site by placing imported soils to original grade.
5. Preparation of South Clive site disposal area and excavation of embankment.
6. Placement of contaminated materials in embankment (1100 x 2000 feet, 6 feet deep).
7. Cover of contaminated materials with 5 feet of locally available soil and 1 to 2 feet of pit run rock.
8. Estimated total cost: \$63.8 million (train) or \$67.7 million (truck).

^a The designs included in this EIS are based upon available information and supporting engineering analyses. It is recognized that there are "margins of error" or "risks" associated with these analyses and that with additional field and laboratory analysis these "margins of error" or "risks" could be reduced. For example, the design for Alternative 2 does not include provisions for preloading (to reduce excessive differential settlement) based upon the analyses to date; however, the State of Utah has indicated that differential settlement may indeed be more of a concern than indicated by the engineering analyses included in this EIS. If preloading were to be required, based upon engineering analyses and cost estimates prepared by the state, an additional 3.0 million cy of fill would be needed for about 2.5 years to preload the site prior to tailings placement. This would increase the cost of Alternative 2 by \$10.8 million to \$42.0 million (letter from State of Utah Department of Transportation to the Department of Health, December 19, 1983).

Table 1-2. Estimated quantities and other pertinent data associated with remedial action operations

Item description	Estimated volume (cubic yards)
<u>Alternative 1</u> - No Action:	
Quantities, personnel, rates not applicable	
<u>Alternative 2</u> - Stabilization on the Vitro site: ^a	
Contaminated Material Relocation	
Excavation outside embankment area	1,370,000
Relocation in embankment area	850,000
Windblown and vicinity properties (spread and compact)	150,000
Rubble	80,000
Preload System ^a	(3,000,000)
Liner System	
Subbase (random fill)	220,000
Base (granular soil)	300,000
Liner (fine grained soil)	190,000
Embankment Cover	
Radon barrier (silty sand)	290,000
Erosion barrier (pit run rock)	155,000
Restoration (select fill)	710,000
Average number of construction personnel	82
Project duration	2.5 years
<u>Alternative 3</u> - Stabilization at South Clive site: train option	
Vitro site:	
Rail spur construction	
Excavation of contaminated materials	180,000
Subgrade and subballast (select fill)	94,000

Table 1-2. (continued)

Item description	Estimated volume (cubic yards)
Contaminated materials	
Tailings and contaminated subsoils	2,220,000
Windblown and vicinity properties	150,000
Rubble	80,000
Restoration (select fill)	945,000
South Clive site:	
Access road construction	
Road subgrade (compacted fill)	27,000
Gravel surface	31,000
Rail spur construction	
Subgrade (compacted fill)	98,000
Subballast (select compacted fill)	10,000
Embankment construction	2,450,000
Cover	
Radon barrier	460,000
Erosion barrier, ditches and perimeter roads (pit run rock)	202,000
Average number of construction personnel	85
Project duration	3 years
Alternative 3 - Stabilization at South Clive site: truck option	
Vitro site:	
Contaminated materials	
Tailings and contaminated subsoils	2,220,000
Windblown and vicinity properties	150,000
Rubble	80,000
Restoration (select fill)	1,040,000
South Clive site:	
Access road construction	
Road subgrade (compacted fill)	27,000
Gravel surface	44,000

Table 1-2. (continued)

Item description	Estimated volume (cubic yards)
Embankment construction	2,450,000
Cover	
Radon barrier (excavated from embankment)	460,000
Erosion barrier, ditches and perimeter roads (imported pit run rock)	202,000
Average number of construction personnel	135
Project duration	3 years

- ^a The designs included in this EIS are based upon available information and supporting engineering analyses. It is recognized that there are "margins of error" or "risks" associated with these analyses and that with additional field and laboratory analysis these "margins of error" or "risks" could be reduced. For example, the design for Alternative 2 does not include provisions for preloading (to reduce excessive differential settlement) based upon the analyses to date; however, the State of Utah has indicated that differential settlement may indeed be more of a concern than indicated by the engineering analyses included in this EIS. If preloading were to be required, based upon engineering analyses and cost estimates prepared by the state, an additional 3.0 million cy of fill would be needed for about 2.5 years to preload the site prior to tailings placement. This would increase the cost of Alternative 2 by \$10.8 million to \$42.0 million (letter from State of Utah Department of Transportation to the Department of Health, December 19, 1983).

1.2.2 Alternative 2 - stabilization at the Vitro site

In this alternative, all on-site tailings and contaminated materials plus those brought in from vicinity properties would be stabilized above grade on a 53-acre area including the southcentral and southeast portions of the Vitro site which would have to be acquired by the State of Utah. The tailings and contaminated material would be placed on a liner system to protect ground-water quality. After stabilization, the release of radon into the air would be reduced to the final EPA standard by a cover of soil. The tailings and other contaminated material would first have to be removed from the stabilization area to allow construction of the liner system. This would be done incrementally over the 53-acre area until the liner system was completed. Contaminated materials would be transported to the stabilization area from elsewhere on the site by truck. Material for the cover and fill for excavations left in other portions of the site is available commercially in Salt Lake Valley. The final stabilized mound would be about 50 feet high. It

would have sloping sides, about 5 horizontal to 1 vertical. It would be stabilized against wind and water erosion by a layer of pit run rock. Finally, ownership of the 53-acre disposal area would be transferred from the State to the DOE and the NRC would issue a license for its long-term maintenance and surveillance (includes monitoring). The remainder of the Vitro site would be released to the CVWRF Board for any use compatible with local land-use controls.

1.2.3 Alternative 3 - decontamination of the Vitro site and disposal of the Vitro material at South Clive

In this alternative all tailings and contaminated materials, including those temporarily stored at the Vitro site from clean-up of vicinity properties, would be stabilized in an excavation at the South Clive site. The industrial strip to the west of the Vitro site would be cleaned up like other vicinity properties; its acquisition would not be necessary.

Contaminated material would be transported from the Vitro site to the South Clive site by either train or truck. For the train option, two 54-car unit trains consisting of covered gondola cars would transport 5400 tons per day. For the truck option, a fleet of 77 trucks would be required to transport the same quantity of tailings to the South Clive site.

Spurs to handle the trains would be built from existing rail lines into both the Vitro site and the South Clive site. A road from the Clive overpass (I-80) would be necessary for access to the embankment. Disposal would be in an excavation about 6 feet deep. The bottom of the excavation would be at least 15 feet above the ground-water table. After being deposited in the excavation, contaminated materials would be covered with 5 feet of on-site cover material derived from the excavation. A 1- to 2-foot-thick layer of pit run rock would be placed over the radon barrier cover to provide protection from erosion. Pit run rock would have to be imported to the site but is available from the nearby Cedar Mountains. Revegetation would not be attempted at the South Clive site because of the arid climate. The state would transfer ownership of the South Clive site to the DOE and the NRC would issue a license for its long-term maintenance and surveillance. The Vitro site would be backfilled to original ground level and released to the CVWRF Board for any use compatible with local land-use controls.

1.3 THE AFFECTED ENVIRONMENT

Although the straight-line distance between them is only 65 miles, the Vitro and the South Clive sites are distinctly different in their settings. The former is in the densely populated Salt Lake Valley; the latter is in the almost completely uninhabited and much drier Great Salt Lake Desert to the west. Three mountain ranges lie between the two locations, but the transportation corridors connecting them follows flat land to the south of Great Salt Lake and to the north of the mountains.

The Vitro site is located in an area that has been and continues to be developed for small industry and warehousing. There is some open land nearby, but the prospects are that it will be built on before the turn of the

century. The street (3300 South Street) on the southern edge of the site is also Utah Highway 171 leading east and west from an interchange off Interstate 15; it carries traffic at the rate of 28,000 vehicles per day.

Much of the Vitro site has been altered by excavations and deposition of tailings, rubble, and sewage sludge. It is easily accessible. A road up its center from 3300 South Street leads to a sewage facility; and only there do gates, fences, and signs prevent the curious visitor from going farther. Vegetation on the site is sparse. The industrial buildings along 900 West Street on the southwest side of the site back right up to a steep bank of tailings.

Some 437,000 people live within 6 miles (10 km) of the Vitro site; 8600 live within 1.2 miles (2 km).

The Salt Lake Valley is semi-arid. Its climate is a result of its location deep in the continent with the Wasatch Mountain range to the east 5000 to 6000 feet higher than the valley and the vast Great Salt Lake to the northwest. Temperatures range from a little under freezing (28°F) in January to 77°F in July. Normal extremes range from nighttime lows of 18°F in January to daytime highs of 93°F in July. The average rainfall is about 15 inches per year, reaching a maximum in the spring. Prevailing winds are from the south through southeast; strong winds tend to come from the west or northwest. Thunderstorms are common in the summer. There is some snow in the winter.

Bedrock below the Vitro site is covered by a thick sequence of alluvial unconsolidated Quaternary deposits at least 500 feet deep overlying semiconsolidated Tertiary clay, sand, and gravel. These deposits carry two principal ground-water systems, a shallow water-table system, and a deeper partially confined system. The water table in the upper system ranges seasonally from 2 to 5 feet below the ground surface, but locally extends up into the base of the tailings. The deeper system is at a higher potential head than the shallower, so that water from the deeper system flows up into the shallow system rather than vice versa.

The shallow water-table system flows slowly to the northwest into the Jordan River, about 1500 feet distant. The Jordan River and its tributaries constitute the main surface-water drains for the valley, discharging into the Great Salt Lake some miles to the north. The drainage ditches within the site and Mill Creek along its northern edge discharge into the Jordan River.

The front of the Wasatch Range is apparently a still-active normal fault. Motion on it or its tributary faults could produce accelerations in rock of as much as 0.3g to 0.55g at the Vitro site.

The area around the Vitro site is an urban ecosystem with vegetation, birds, and wildlife of the sorts that have accommodated themselves to the presence of man. No endangered or threatened species are known to be present.

The Vitro site contains 2.9 million tons of tailings and other contaminated materials. It is estimated that there are 1500 curies of Ra-226 in secular equilibrium with radon and its daughter products in the tailings.

The South Clive site is in the eastern edge of the Great Salt Lake Desert, 3 miles west of the Cedar Mountains, 2.5 miles south of Interstate 80, and 1 mile south of a switch point called Clive on the tracks of the Union Pacific system. The area is uninhabited and only occasionally used for grazing and off-road vehicles.

The South Clive area is arid desert. Data from the Wendover meteorological station 40 miles to the west suggest that temperatures are similar to those at the Vitro site, normally ranging from 27°F in January to 79°F in July. Normal extremes range from nighttime lows of 19°F in January to daytime highs of 92°F in July. The average rainfall at Wendover is only 5 inches per year. Thunderstorms occur in the summer. There is some snow in the winter.

Knowledge of the geology of the South Clive site is incomplete. Holes drilled in preparation for this report indicate that the surface alluvial material is at least 150 feet deep. This soil contains a water-table ground-water system that is 20 to 30 feet below the surface. The regional direction of ground-water flow is to the west, but locally the flow is to the northeast. There are no perennial surface water bodies within 2 miles, nor even gullies indicating intermittent channelized flow; from this it is inferred that runoff on the hills to the east percolates into the ground before it reaches the South Clive site.

The South Clive site is located in a region which contains active faulting. Active fault studies indicate maximum expected accelerations in bedrock of 0.37 g.

Ecologically, the area around the South Clive site is a desert scrubbrush community. No endangered or threatened species are known to be present.

Background radiation levels at the South Clive site are low and similar to those near the Vitro site. The background gamma radiation level is about 12 μ R/hr and the atmospheric radon concentration is about 0.3 pCi/l.

The transportation corridors between the Vitro and the South Clive sites consist principally of Interstate 80 (and its connecting roads in Salt Lake City) and the tracks of the Union Pacific and the Denver and Rio Grande Western Railroads. There are a number of towns south of the corridors, notably Tooele (population 14,335) and Grantsville (population 4419).

1.4 ENVIRONMENTAL IMPACTS

Attention is focused in this section on the principal environmental impacts of the three alternatives studied. Table 1-3 is a comparative summary of these impacts.

The major impact of Alternative 1, no action, would be the continued, uncontrolled presence of the Vitro tailings in the heart of the densely populated Salt Lake Valley. Radiation levels and radon fluxes and concentrations would remain above the EPA-proposed standards near the site. These exposures would continue to cause 0.6 deaths in 3 years from lung

Table 1-3. Comparisons of the impacts of the alternatives

	Alternative 1	Alternative 2	Alternative 3 (train)		Alternative 3 (truck)	
<u>Radiological short-term</u>						
Excess external dose (man-rem):						
Population (6 miles)	330/3 years	150/3 years	150/3 years		150/3 years	
Work force	---	65/3 years	280/3 years		350/3 years	
Excess bronchial dose (man-rem):						
Population (6 miles)	28,000/3 years	15,000/3 years	15,000/3 years		15,000/3 years	
Work force	---	480/3 years	740/3 years		600/3 years	
Excess cancer deaths:						
Population (6 miles)	0.6/3 years	0.3/3 years	0.3/3 years		0.3/3 years	
Work force	---	0.02/3 years	0.05/3 years		0.05/3 years	
<u>Radiological long-term, after remedial action</u>						
Excess external dose (man-rem):						
Population (6 miles)	110/year	none	none		none	
Excess bronchial dose (man-rem):						
Population (6 miles)	9,400/year	negligible	none		none	
Excess cancer deaths:						
Population (6 miles)	0.2/year	none	none		none	
<u>Air Quality short-term^A</u>						
Emissions in tons per year	No effect		<u>Vitro</u>	<u>Clive</u>	<u>Vitro</u>	<u>Clive</u>
TSP		317.5	313.8	235.3	448.1	560.8
SO ₂		3.1	30.4	30.4	21.8	21.8
CO		8.1	87.1	87.1	201.6	201.6
NO _x		40.0	246.7	246.7	181.7	181.7
HC		2.5	51.7	51.7	33.6	33.6
Exhaust Particulates		2.0	15.7	15.7	11.0	11.0
<u>Topography</u>						
	No effect	<u>At Vitro</u> A mound 50 ft high on 53 acres.	<u>At Vitro</u> Site is returned to grade.		same as train option	
			<u>At Clive</u> A mound 34 ft high on 55 acres.			
<u>Soils</u>						
	No effect	<u>At Vitro</u> Import ^B 1,865,000 cu yds of soils, rock, and clay.	<u>At Vitro</u> Import ^B 1,040,000 cu yds of soil.		same as train option	
			<u>At Clive</u> Import ^B 1,040,000 cu yds of rock.			
<u>Surface Water</u>						
	Continued low-level contamination of ditches and creeks at Vitro site.	No further contamination of ditches and creeks at Vitro	<u>At Vitro</u> No possibility of future contamination.		same as train option	
			<u>At Clive</u>			

Table 1-3. (Continued)

	Alternative 1	Alternative 2	Alternative 3 (train)	Alternative 3 (truck)
<u>Land Use</u>	No effect: The tellings continue to interfere with CVWRF Board proposed expansion plans.	About 60 % of site released for use by CVWRF Board.	<u>At Vitro</u> 100% of site released for use. <u>At Clive</u> 60 acres of land in restricted use.	same as train option
<u>Populations & Employment</u>	No effect			
Number of short-term ^a jobs		215	207	317
Number of long-term ^c jobs		0	705	705
<u>Transportation</u>	No effect	8.5% maximum increase in traffic along haul route (5400 South) ^a to Vitro site	4% maximum increase in traffic along haul route to Vitro site (there is no traffic at Clive). ^a	negligible increase on I-80; 4% maximum increase in traffic along haul route to Vitro site ^a
<u>Use of Energy</u>	None			
Electricity (kwh)		400,000	800,000	800,000
Engine fuel (gal)		2,520,000	6,970,000	7,121,000
<u>Occupational Accidents^c</u>	None			
Expected deaths		0.15	0.14	0.52
Expected number of disabling injuries		12	27	25
<u>Cost of Project</u>	None			
In millions of 1982 dollars		\$31.2	\$63.8	\$67.7
<u>Annual Economic Benefits Attributable to Development of a Temporary Industrial Park on Vitro Site (In millions of 1983 dollars (gross))</u>	None ^d	Unknown ^e	\$11.0	\$11.0

^aFor 1-year duration of projects in Alternative 2 and 3 only; generally zero effect after 1 years.

^bImport from commercial soil suppliers.

^cLong-term jobs include direct (271) and indirect (434)

employment associated with the temporary industrial park (see Appendix I for explanation of temporary industrial park).

^dImpact on region could be mitigated by development on an alternate site.

^eUnder Alternative 2, 20 acres will be available for development. Impact depends on type of development undertaken.

cancer. The nearest resident to the Vitro tailings pile would continue to receive an annual exposure of more than one rem.

In addition, no remedial action would mean continued interference of the tailings with the proposed expansion plans of the Central Valley Water Reclamation Facilities (CVWRF) Board; additional sewage facilities will be needed to serve the population growth projected for the Salt Lake Valley.

Either Alternative 2 or Alternative 3 would be designed to meet the final EPA standards. The radon flux standard would be met by adding enough cover so that by the time radon gas has diffused through the cover, most of the gas would have decayed into solid daughter products that would move no further. The longevity of this cover would be ensured by armoring its surface with pit run rock to prevent wind and water erosion.

In Alternative 2, ground-water systems would be protected by the use of a liner system that would elevate the tailings above the water table. Also, the liner system would reduce the rate of water movement from the tailings into sediments beneath the embankment. This reduction in moisture migration may be expected to increase the effectiveness of geochemical processes (e.g., sorption and precipitation) in reducing the rates of aqueous contaminant migrations from the stabilized tailings.

In Alternative 3, the tailings would be at least 15 feet above the water table at the South Clive site. No liner is needed because net infiltration through a low permeability cover and the tailings would not be sufficient to substantially further degrade the poor ground-water quality beneath the Clive site. Alternative 3 would also eliminate any possibility of further contamination of ground water at the Vitro site by removal of the tailings.

In Alternative 2 or Alternative 3, aquifer restoration does not seem warranted because the range of calculated cost:benefit ratios is high (4.1 to infinity) and there is no ground water use in the possibly contaminated area.

Surface-water systems would be protected in Alternative 2 both indirectly by the protection of ground water indicated above (since the ground water at the Vitro site discharges into the Jordan River) and directly by the cover diverting runoff, thus keeping it from percolating into the tailings. In Alternative 3, there is no surface water to protect at the South Clive site. In Alternative 3, contaminated wash-down water from cleaning railcars or trucks would be impounded and evaporated if contaminant levels exceeded applicable limits. Removal of the tailings to the South Clive site would also eliminate any possibility of further surface-water contamination at the Vitro site.

Alternative 2, stabilization on the Vitro site, would not completely eliminate interference with the proposed expansion plans of the CVWRF Board, because 53 acres of the site would be used for in-place stabilization of the mill tailings. However, development of the parcel (approximately 20 acres) in the southwest corner of the site might permit land uses consistent with the CVWRF Board's approved Master Plan. Therefore, Alternative 2 might require some revision of the board's plans.

Either Alternative 2 or Alternative 3 would reduce the long-term radiation exposures being experienced by people living in the Salt Lake Valley. Alternative 2 would reduce the fluxes causing these exposures. Alternative 3 would eliminate them entirely and not expose other people, inasmuch as no one lives near the South Clive site.

In the short term, the process of carrying out either Alternative 2 or Alternative 3 would expose workers and the public near the Vitro site to some radiation during the time required for the remedial action. This public exposure is estimated to be 15,000 manrems for both alternatives, respectively, resulting in an additional 0.3 death from cancer.

From points of view other than radiological, the work required in either Alternative 2 or Alternative 3 is much like that of any large earth-moving project, with noise, dust, and additional truck traffic. There is the possibility of some industrial accidents occurring among the remedial-action workers.

The direct employment impact of either Alternative 2 or Alternative 3 on the economy of the Salt Lake Valley will not be significant. This is because direct construction employment under Alternative 2 will average 82 jobs; under Alternative 3, an average of 85 (train) or 135 (truck) jobs would be created. However, there may be a small effect on the much smaller economy of Tooele County.

Under Alternative 3, the development by the CVWRF Board of a temporary industrial park (see Appendix I for details) on the CVWRF Board's 3300 South Street frontage property is projected to have direct and indirect employment impacts of 271 jobs and 434 jobs, respectively. The gross economic benefits of such a development to the region have been estimated at \$11.0 million per year.

Inmigration in response to employment opportunities created by construction activity under Alternatives 2 or 3 and the temporary industrial park under Alternative 3 is expected to be minimal.

Finally, there is a difference in construction costs among the three alternatives. Construction costs associated with Alternative 1 would be zero. Alternative 2 would cost approximately \$31.2 million, including land costs. Alternative 3 would cost approximately \$63.8 (train) or \$67.7 (truck) million.

1.5 REMEDIAL ACTIONS

Additional information on the remedial-action activities at the two sites will be published as indicated in Table 1-4.

1.6 MAINTENANCE AND SURVEILLANCE

After all of the cleanup work is finished, the DOE, or another Federal agency charged with custody of the disposal site, would continue to monitor the final disposal site to ensure that the remedial-action program continues to comply with the EPA standards (40 CFR 192). This could include measurements of parameters such as air and water contaminant levels as specified by the NRC in its license, and maintenance of the site as required. The EPA standards (40 CFR 192) would have to be met before the remedial action is considered officially completed.

Table 1-4. Document publication schedule - Salt Lake City
remedial-action project

Document type	Scheduled publication date
<u>Final site documents</u>	
Remedial action plan	Summer 1984
Site conceptual design	Summer 1984
Site design criteria	Summer 1984
Site characterization report	Summer 1984
Final design and specifications	Fall 1984
Site licensing plan	1986
Site surveillance and maintenance plan	1986

2 PURPOSE AND NEED

2.1 INTRODUCTION

In the metropolitan area of Salt Lake City, Utah, there is an abandoned uranium mill waste storage area (Figure 1-1). The mill was operated by the Vitro Chemical Company of America which processed uranium ore for sale to the U.S. Atomic Energy Commission from 1951 to 1964. When the plant was dismantled in 1970, the radioactively-contaminated materials from the processing operations remained on the site. These materials, called tailings, are mostly in the form of finely crushed rock, much like sand, and are piled up to 16 feet high over more than 100 acres of partly fenced land. Some of the tailings were removed and used in construction projects in the Salt Lake City area. It is estimated that 100 properties in the area have been affected by these construction activities. The bulk of the tailings, however, remain at the Vitro site.

2.2 PURPOSE AND NEED

In 1978, Congress passed Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), based on their finding that uranium mill tailings located at inactive (and active) mill sites may pose a potential health hazard to the public. UMTRCA charges the EPA with the responsibility for promulgating radiological and nonradiological standards for inactive mill sites. Under UMTRCA the U.S. Department of Energy (DOE) is authorized to enter into cooperative agreements with affected states or Indian tribal governments to perform remedial actions to bring the radiation levels at the sites in their jurisdiction within the EPA standards. The DOE will fund 90 percent of the remedial-action-cleanup costs (except on Indian land where DOE will fund 100 percent); the affected state will provide the remaining 10 percent. All remedial actions must be performed with the concurrence of the U.S. Nuclear Regulatory Commission (NRC), which will issue a license for long-term maintenance and surveillance of the site following completion of remedial action.

Title I of the UMTRCA identified 22 sites, including the Vitro site, to be designated by DOE for remedial action, which was done on November 8, 1979. As a result, the DOE and the State of Utah entered into a cooperative agreement effective January 30, 1981 for remedial action at the Vitro site. During summer 1984, the cooperative agreement will be modified to designate the State of Utah as the party to perform remedial actions on the uranium mill tailings and to reflect changes to the agreement that result from this designation.

The purpose of the actions analyzed in this EIS is to implement the remedial action program by stabilizing and controlling potentially hazardous radioactive materials associated with the former Vitro uranium mill, including those materials recovered in the cleanup of vicinity properties. The program to clean up vicinity properties was addressed in a separate environmental assessment (EA) prepared for it (DOE, 1982) and is not discussed in the EIS.

The need for remedial action at the Vitro site rests on the need to remove a potential health hazard posed by radioactive materials. The U.S. Congress, in considering Public Law 95-604, heard testimony explaining this potential hazard and recommending that efforts be made to keep the radioactive materials from being dispersed (U.S. Congress, 1978, pp. 7451-7456). Congress, therefore, included in the law a finding that "uranium mill tailings located at active and inactive mill operations may pose a potential and significant radiation health hazard to the public" The severity of the hazard is difficult to measure precisely because the immediate effects of such low-level radioactivity are not pronounced enough to be clearly recognizable. The principal effect on public health to be expected from the Vitro site contamination would be a long-term increase in lung cancer among people living in the surrounding area. One estimate of this increase, presented to Congress in 1978, was that the Vitro tailings might produce about one additional cancer each year in the Salt Lake City area (U.S. Congress, 1978, p. 7453). Because about 44 lung cancers occur each year in that area (HEW, 1968), an increase of 1 cancer would be impossible to demonstrate conclusively. The estimated severity of the hazard, therefore, rests on predictions made by mathematical calculations rather than on direct measurements of health effects.

The estimated hazard presented to Congress in 1978 was based on such calculations; since then, more detailed calculations have been performed by the U.S. Environmental Protection Agency as part of its efforts to set standards for the remedial action (EPA, 1980). The EPA calculations emphasized the health effects caused by inhalation of radon-daughter products that are produced by the radon emitted from the Vitro site. These calculations suggest that the Vitro site contamination might produce 0.7 to 0.8 fatal cancers each year in the population within 6 miles of the site; an additional 0.04 to 0.05 fatal cancers might appear each year among people living between 6 and 50 miles away. The risk would be greatest for people close to the site and would decrease for people living at greater distances.

Radioactive materials associated with the Vitro site, then, could be expected to produce fewer than one human fatality a year in the surrounding population; that fatality would be indistinguishable among the thousands of deaths each year in the metropolitan area. These small numbers do not, however, fully reveal the hazard, because the radioactive decay taking place in the contaminated material will continue to produce radioactive elements for thousands of years into the future. In thousands of years, the total number of deaths caused by the radioactivity could become large, although it would still be small in comparison with the total number of deaths from all causes. For example, if the EPA estimates are correct, 740 to 850 additional lung cancer cases might have appeared in the population within 50 miles of the Vitro site after 1000 years had elapsed. According to the testimony given before Congress,

"The health effects of this radon production are tiny as applied to any one generation, but the sum of these exposures can be made large by counting far into the future . . . Whether it is meaningful to attach significance to radiation exposures thousands of years in the future, or conversely, whether it is justifiable to ignore them, are questions

without easy answers. The most satisfactory approach is to require every reasonable effort to dispose of tailings in a way that minimizes radon diffusion into the atmosphere" (testimony of NRC Chairman J.M. Hendrie, p. 7452 in U.S. Congress, 1978).

This kind of reasoning establishes the primary need for the remedial actions at the Vitro site. In terms of actual numbers of fatalities, the effects of the tailings will remain an indiscernably small fraction of the deaths that will occur from other causes near the site. Making a "reasonable effort," however, will eliminate the potential hazard. For this reason Congress chose to provide a program of assessment and remedial action at mill tailings sites in which DOE establishes the required remedial actions at inactive tailings locations, including the former Vitro site.

REFERENCES FOR CHAPTER 2

- DOE (U.S. Department of Energy), 1982. Environmental Assessment of Preliminary Cleanup Activities at Offsite Properties Contaminated by Tailings from the Inactive Uranium Mill Site Near Salt Lake City, Utah, DOE/EA-0186, Washington, D.C.
- EPA (U.S. Environmental Protection Agency), 1980. Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, EPA 520/4-80-011, Washington, D.C.
- HEW (U.S. Department of Health, Education and Welfare), 1968. Vital Statistics of the United States, Volume II - Mortality, National Center for Health Statistics, Washington, D.C.
- U.S. Congress, 1978. U.S. Code, Congressional and Administrative News, 95th Congress--Second Session, Vol. 6, "Legislative History," pp. 7433-7478, Washington, D.C.

3 ALTERNATIVES FOR THE REMEDIAL ACTION

3.1 INTRODUCTION

The mission of the Uranium Mill Tailings Remedial Action (UMTRA) Project at South Salt Lake is to carry out a cleanup program according to the EPA standards for the disposal of tailings and for the cleanup of open lands and structures. An objective of the UMTRA Project is to combine at one location the tailings, the contaminated soils, and the other contaminated materials from the site and the vicinity properties. The final disposal site will be owned by the Federal government and its maintenance and surveillance will be licensed by the NRC. By combining and stabilizing all tailings and contaminated materials at one disposal site, potential health effects caused by exposure to the tailings will be minimized, and all other presently contaminated areas will be cleaned up sufficiently to be released for unrestricted use.

3.1.1 EPA standards

General

Pursuant to the requirements of UMTRCA, EPA has promulgated health and environmental standards to govern cleanup, stabilization, and control of residual materials at inactive uranium mill tailings sites and associated vicinity properties. The promulgated standards establish requirements for long-term stability and radiation protection and provide procedures for ensuring the protection of ground-water quality.

In developing the standards, EPA determined "that the primary objective for control of tailings should be isolation and stabilization to prevent their misuse by man and dispersal by natural forces such as wind, rain and flood waters" and that "a secondary objective should be to reduce radon emissions from tailings piles." (Ref. preamble to Standards for Remedial Actions at Inactive Uranium Processing Sites, 40 CFR Part 192.) These conclusions were based on a determination that the most significant public health risks associated with inactive tailings were posed by exposure to people living and working in structures contaminated by relocated tailings. EPA further concluded that the potential for contamination of ground water and surface water should be evaluated on a site-specific basis.

The EPA standards are discussed in the following paragraphs and are summarized in Table 3-1.

Long-term stability

Isolation and stabilization of tailings in order to prevent misuse by man and dispersal by natural forces is the primary objective of the EPA standards. Accordingly, long-term stability was emphasized in the development and promulgation of the standards. This is consistent with the guidance provided by the legislative history of UMTRCA, which stresses the importance of avoiding remedial actions which would be effective only for a short period of time and which would require future Congressional consideration.

PART 192 - HEALTH AND ENVIRONMENTAL PROTECTION STANDARDS FOR URANIUM MILL TAILINGS

SUBPART A - Standards for the Control of Residual Radioactive Materials from Inactive Processing Sites

192.02 Standards

Control shall be designed to:

- (a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,
- (b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:
 - (1) Exceed an average release rate of 20 picocuries per square meter per second, or
 - (2) Increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter.

SUBPART B - Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites

192.12 Standards

Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site:

- (a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than -
 - (1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and
 - (2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.
- (b) In any occupied or habitable building -
 - (1) The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and
 - (2) The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.

SUBPART C - Implementation (condensed)

192.20 Guidance for Implementation

Remedial action will be performed with the "concurrence of the Nuclear Regulatory Commission and the full participation of any state that pays part of the cost" and in consultation as appropriate with other government agencies and affected Indian tribes.

192.21 Criteria for Applying Supplemental Standards

The implementing agencies may apply standards in lieu of the standards of Subparts A or B if certain circumstances exist, as defined in 192.21.

192.22 Supplemental Standards

"Federal agencies implementing Subparts A and B may in lieu thereof proceed pursuant to this section with respect to generic or individual situations meeting the eligibility requirements of 192.21."

- (a) "...the implementing agencies shall select and perform remedial actions that come as close to meeting the otherwise applicable standards as is reasonable under the circumstances."
- (b) "...remedial actions shall, in addition to satisfying the standards of Subparts A and B, reduce other residual radioactivity to levels that are as low as is reasonably achievable."
- (c) "The implementing agencies may make general determinations concerning remedial actions under this Section that will apply to all locations with specified characteristics, or they may make a determination for a specific location. When remedial actions are proposed under this Section for a specific location, the Department of Energy shall inform any private owners and occupants of the affected location and solicit their comments. The Department of Energy shall provide any such comments to the other implementing agencies [and] shall also periodically inform the Environmental Protection Agency of both general and individual determinations under the provisions of this section."

Ref: Federal Register, Volume 48, No. 3, January 5, 1983, 40 CFR Part 192.

TABLE 3-1 EPA STANDARDS

The EPA standard-setting process distinguished "passive controls," such as thick earthen and rock covers from "active controls" such as semi-permanent covers, fences, warning signs, and restrictions on land use. Active controls could be expected to need frequent replacement or other major repairs requiring the appropriation and expenditure of public funds. In setting the standards, EPA called for designs which rely primarily on passive controls.

The standards are framed as a longevity requirement which recognizes the difficulty in predicting very long-term performance with a very high degree of confidence. In establishing the longevity requirement, EPA concluded that existing knowledge permits the design of control systems that have a good expectation of lasting at least 1000 years. Therefore, a design objective of 1000 years was established to be satisfied whenever reasonably achievable, but in any case with a minimum performance period of 200 years.

The standards recognize the need for institutional controls such as custodial maintenance, monitoring, and contingency response measures. In its preamble to the standards, EPA calls for such controls to be provided as an essential backup to the primary passive controls.

Radon emissions control

EPA identified a reduction of radon emissions from tailings piles as the second objective in its standards for the control of tailings. In developing the standards, it considered several alternative approaches and selected an emission limitation as the primary form of the standard. In addition, it established an equivalent concentration limit as an alternative form of the standard for use in cases where the DOE determined that the alternative was appropriate.

In establishing the emission limitation for tailings piles, EPA sought to reduce both the maximum risk to individuals living very near to the sites and the risk to the population as a whole. With regard to individuals very near disposal sites, EPA estimates that exposure to radon emissions will be reduced by more than 96 percent. The radon standard of 20 pCi/m²sec on the disposal site or 0.5 pCi/l outside the disposal site will limit the increase in radon concentration attributable to a pile to a small increase above the background radon level near the disposal site. Both standards are design standards with compliance to be determined on the basis of predicted rather than measured emission rates and concentrations. EPA states that "post-remediation monitoring will not be required to show compliance, but may serve a useful role in determining whether the anticipated performance of the control system is achieved."

In establishing the radon standard, EPA determined that the emission limitation could be achieved by well-designed thick earthen covers and that such control techniques would be compatible with those required to meet the longevity standard.

Water-quality protection

EPA reviewed available water-quality data at inactive tailings sites and determined that there was little evidence of recent movement of contaminants into ground water. They also determined that any degradation of ground-water

quality should be evaluated in the context of potential beneficial uses of the ground water as determined by background water quality and the available quantity of ground water.

Rather than establish specific numerical limitations for contaminant discharges or ground-water quality, EPA determined that the most appropriate course of action would be to require site-specific analyses of potential future contaminant discharge and case-by-case evaluation of the significance of such a discharge. The implementation guidelines for the EPA standards call for adequate hydrologic and geochemical surveys at each site as a basis for determining whether specific water-producing measures should be applied.

Specific site assessments must include monitoring programs sufficient to establish background ground-water quality through one or more upgradient wells and to identify the present movement and extent of contaminant plumes associated with the tailings piles. They further call for judgements of the need for restoration or prevention, or both, to be guided by EPA's hazardous waste management system and relevant state and Federal water-quality criteria. Decisions on specific actions to protect or restore water quality are to be guided by such factors as the technical feasibility of improving the aquifer, the cost of applicable restorative or protective programs, the present and future value of the aquifer as a water source, the availability of alternative water supplies, and the degree to which human exposure is likely to occur.

UMTRCA requires that the standards promulgated by EPA ". . .to the maximum extent practicable, be consistent with the requirements of the Solid Waste Disposal Act, as amended." In setting the standard, EPA determined that the statutory requirement for NRC to concur with the selection and performance of remedial actions and to issue licenses encompassing "monitoring, maintenance, or emergency measures necessary to protect public health and safety" were consistent with the EPA regulations implementing the Solid Waste Disposal Act (47 FR 32274, July 26, 1982). Accordingly, EPA established the implementation procedures requiring case-by-case evaluations of existing and potential contamination at sites. Decisions regarding monitoring or remedial actions will be guided by relevant considerations in the hazardous waste management systems.

Cleanup of lands and buildings

The EPA evaluated the risk associated with the dispersal of tailings off the site and concluded that the principal risk to man is the exposure to radon daughter products inside buildings. EPA therefore stated that the objective of the cleanup of tailings from around existing structures is to achieve an indoor radon daughter concentration (RDC) of less than 0.02 WL. For open lands, the purpose of removing the contamination is to remove the potential for excessive indoor radon daughter concentrations that might arise from new construction on contaminated land. The 5 pCi/g and 15 pCi/g Ra-226 concentration limits for 15-cm surface and subsurface layers were considered adequate to limit indoor RDCs to below 0.02 WL. A secondary concern was to limit exposure to people from gamma radiation.

Standards state that residual radioactive materials should be removed from buildings exceeding 0.03 WL. In cases where levels are between 0.02 and 0.03 WL, the use of sealants, filtration devices, or ventilation devices is encouraged to avoid the excessive costs of additional removal of contaminated material to meet the objective of 0.02 WL.

3.1.2 NRC concurrence

The DOE will select and execute a plan of remedial action that will satisfy the EPA standards. In conformance with the UMTRCA, the required NRC concurrence in proposed remedial actions will be for the purpose of ensuring compliance with these standards.

The NRC is required by the UMTRCA to license the final tailings-disposal sites following completion of the remedial action. Section 104(f) (2) of the act states that "upon completion of the remedial action program . . . such property and minerals shall be maintained pursuant to a license issued by the Commission (the NRC) in such manner as will protect the public health, safety, and the environment. The Commission may . . . require the Secretary (of the DOE) or other Federal agency having custody of such property and minerals to undertake such monitoring, maintenance, and emergency measures as necessary to protect public health and safety and other actions as the Commission deems necessary"

3.2 DESCRIPTION OF THE ALTERNATIVES

The remaining sections of this chapter describe the alternative remedial actions for eliminating the potential hazards associated with the inactive Vitro site. The descriptions of these alternatives are followed by a comparative summary of the environmental impacts that would be associated with the alternatives.

3.2.1 Background

The Vitro site (Figures 3-1 and 3-2) encompasses an area of about 128 acres and is located 4 miles south-southwest of the center of Salt Lake City, at the northeast corner of the street intersection of 3300 South and 900 West. The Central Valley Water Reclamation Facility (CVWRF) sewage-treatment plant is located on adjacent property north of the central portion of the site. The entire site is presently owned by the CVWRF Board.

The site is bounded on the north by the CVWRF and the channel of Mill Creek, on the east by the tracks of the Denver and Rio Grande Western Railroad, on the south by 3300 South Street and on the west by 900 West Street. A 5.4-acre industrial area occupies a 225-foot wide strip adjacent to the west edge of the south half of the site facing 900 West Street. Another industrial facility is situated adjacent to the southeast corner of the site. The nearest residences to the Vitro site are about 300 feet away from its southwestern corner, across 3300 South Street.

The site can be roughly divided into four areas: the former mill and ore storage area, and three former tailings storage areas labeled "northwest," "southwest," and "southeast" on Figure 3-2. The southwest and southeast

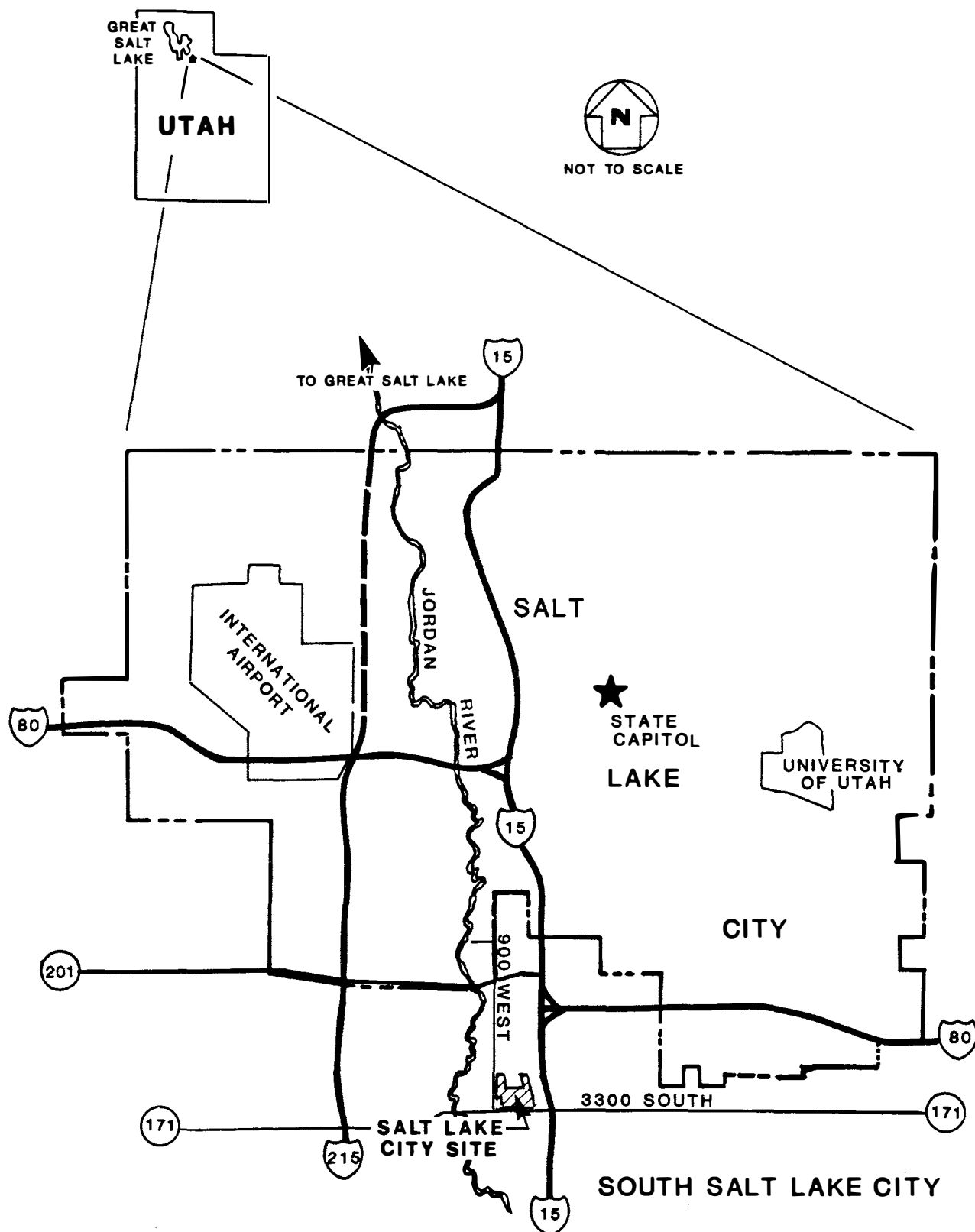


FIGURE 3-1
LOCATION MAP OF THE SALT LAKE CITY SITE
SOUTH SALT LAKE CITY, UTAH

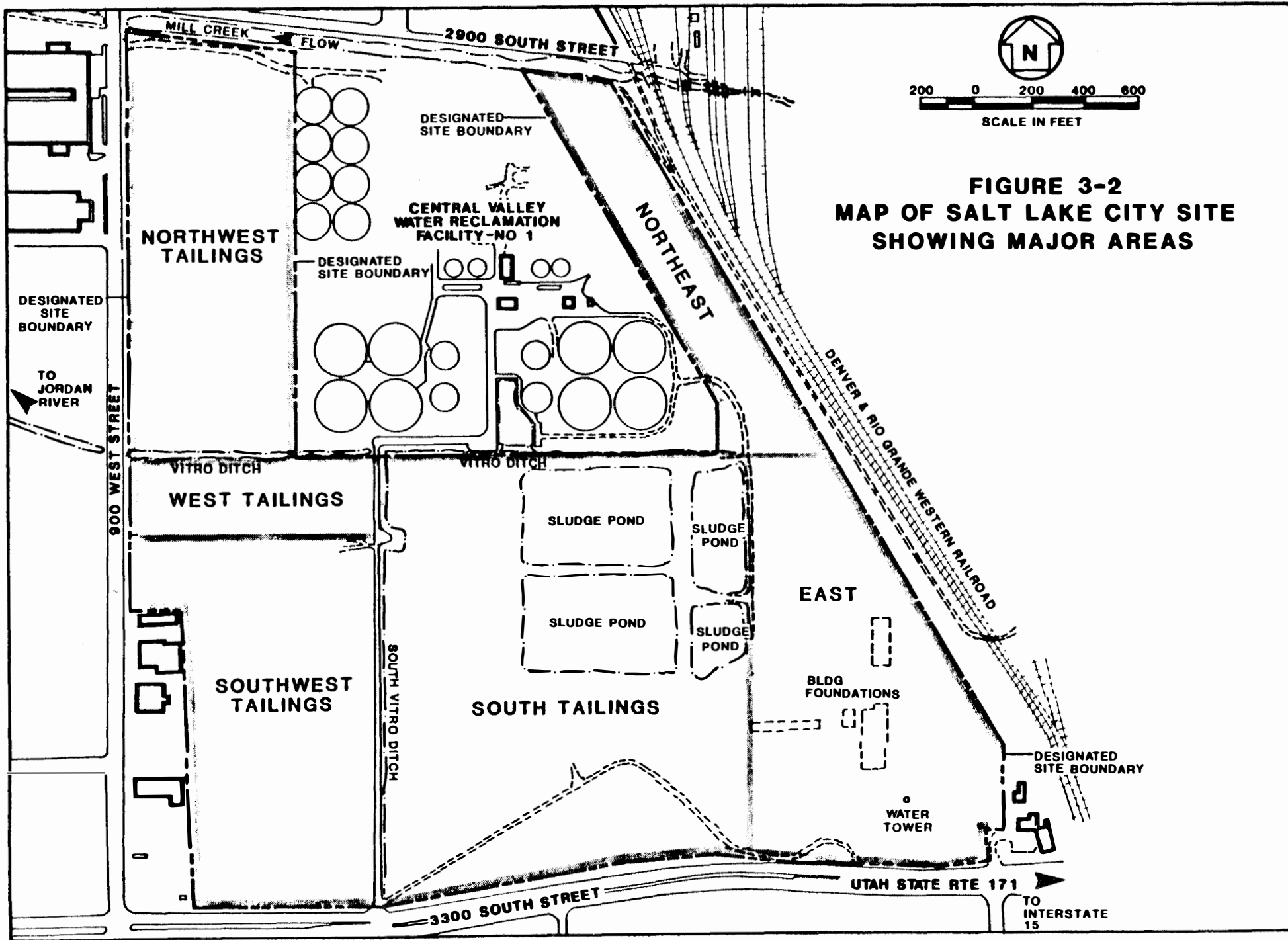


FIGURE 3-2
MAP OF SALT LAKE CITY SITE
SHOWING MAJOR AREAS

tailings areas are separated by the South Vitro Ditch, which is part of a storm-sewer system that gathers surface water from areas south of the site. The northwest and southwest tailings areas are separated by the Vitro Waste Ditch, which carries treated water from the CVWRF. The eastern portion of the Vitro site was used for the ore processing mill, ore storage, and transportation facilities. The buildings were removed, but various foundations and concrete supports were left in place or were buried at the site. This portion of the site remains at approximately natural ground surface level. The remaining structures include a water tower and railroad tracks.

Since 1970, after milling operations at the Vitro site were terminated, the surface of the site has been altered considerably in several places. In the northwest tailings area, approximately 13 acres are covered with sludge from the CVWRF sewage-treatment plant. The northern half of the southwest tailings area contains an excavation approximately 10 feet deep and 600 feet long in the east-west direction. Excavated material on the order of 20 feet in height lies to the north and to the south of the excavation. Small amounts of debris and concrete rubble are scattered across the southwest and southeast tailings areas.

At present, off-site property cleanup projects are bringing contaminated material onto the southeast tailings and stockpiling it in a fenced low-lying area. Some of the imported material is concrete rubble, but most of it is sandy tailings that were originally taken from the site for use as fill. A recently-constructed system of unlined sludge ponds in the north portion of the southeast tailings area is currently accumulating sludge from the CVWRF plant.

Estimates of the contaminated materials that are involved in the remedial action are summarized in Table 3-2.

Table 3-2. Contaminated materials on Vitro site

Material	Volume (cubic yards)
Tailings and other contaminated materials	2,220,000
Rubble	80,000
Off-site windblown	50,000
Off-site other than windblown	<u>100,000</u>
TOTAL	2,450,000

There are two basic strategies available for carrying out the remedial actions at the Vitro site: the first strategy is to stabilize the tailings and other contaminated materials at the Vitro site; the second strategy is to transport the materials to a new disposal site and decontaminate the Vitro site (DOE, 1982a).

The primary difference between a site that has been decontaminated and one that contains stabilized, radioactively contaminated material is that a decontaminated site will contain no material above the EPA standards and will be available for unrestricted use. A stabilized site will meet the EPA standards but will still contain the radioactive material and, therefore, must remain undisturbed to protect the containment. Thus, its future use will be permanently restricted.

Three alternative actions have been specifically developed for dealing with the tailings and other contaminated materials at the Vitro site. These alternatives are:

- o Alternative 1 -- No action.
- o Alternative 2 -- Stabilization of all material on the Vitro site.
- o Alternative 3 -- Decontamination of the Vitro site and transfer of all contaminated material to a new disposal site (i.e., South Clive site) located 1 mile south of Clive, Tooele County, Utah.

These three alternatives are believed to span the spectrum of reasonable alternatives for the remedial action. Other alternatives were identified but eventually eliminated from further consideration as reasonable alternatives in this EIS; these considered-but-rejected alternatives are briefly discussed in Section 3.2.5, and in more detail in Appendix C.

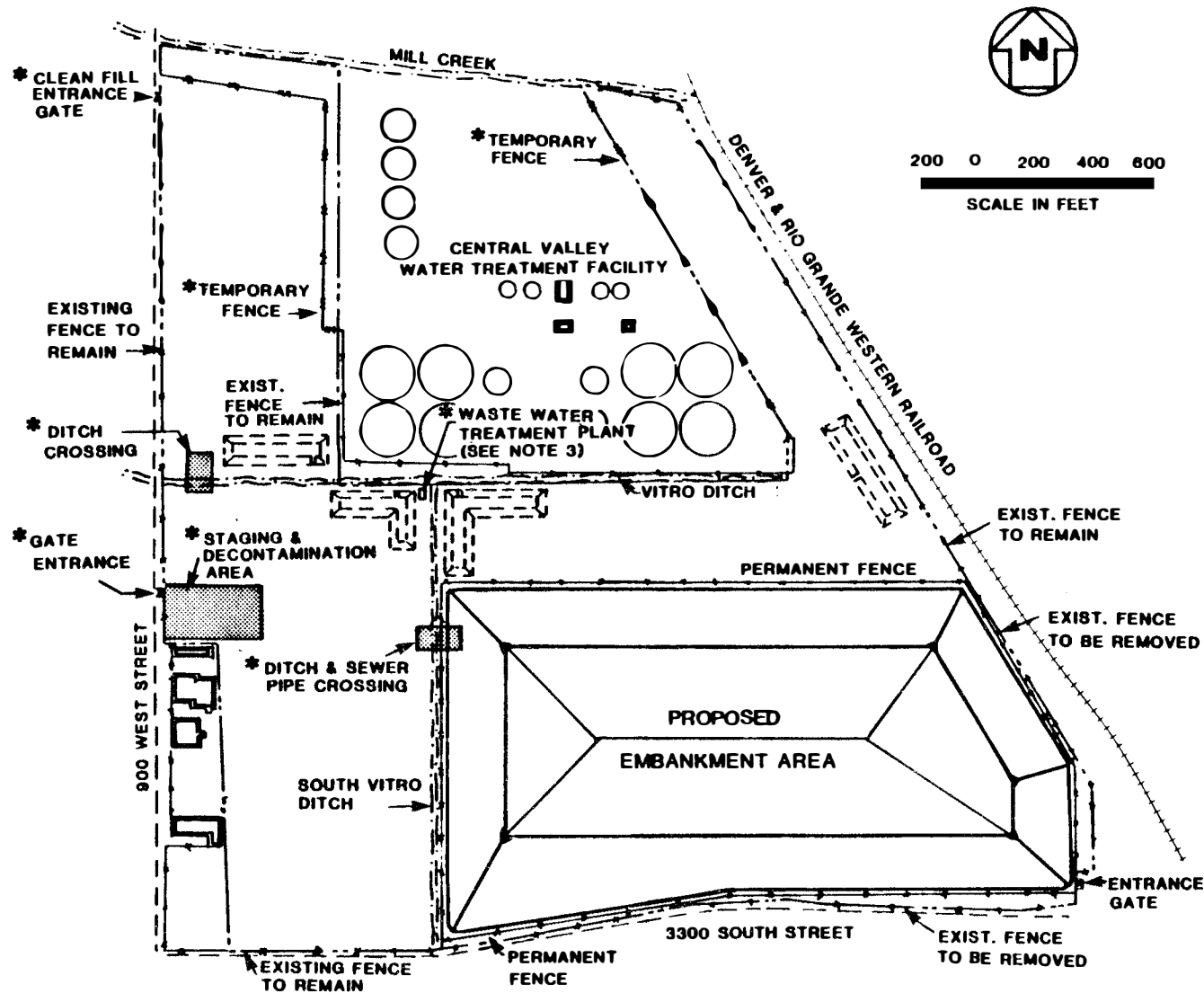
3.2.2 Alternative 1 -- no action

This alternative would entail leaving the Vitro site in its present condition and under the control of its present owners, the CVWRF Board.

3.2.3 Alternative 2 -- stabilization on the Vitro site

In this alternative, all tailings and contaminated materials would be stabilized on a 53-acre area at the Vitro site (Figure 3-3). The location of this area was chosen to minimize interference with the ongoing expansion of the CVWRF waste-treatment plant site and to release the maximum amount of land for unrestricted use.

Before stabilization of wastes could begin, the required 53 acres of the site would be acquired by the State of Utah and permission to clean up the remainder of the 128-acre tract would be obtained from the CVWRF Board. The materials obtained in the cleanup of vicinity properties would be deposited on the Vitro site, to be later stabilized with the on-site materials.



NOTES

- 1 FOR BOUNDARY SURVEY AND BASIS OF BEARINGS SEE "VITRO PLANT SITE SURVEY" DATED NOVEMBER 2, 1982. PREPARED BY WESTERN DESIGN CONSULTANTS FOR FORD, BACON & DAVIS UTAH INC
- 2 AERIAL TOPOGRAPHY BY OLYMPUS AERIAL SURVEY INC, SALT LAKE CITY, UTAH DATED SEPTEMBER 18, 1982
- 3 WASTE WATER TREATMENT PLANT TO BE LOCATED AS REQUIRED DURING CONSTRUCTION SEQUENCE

LEGEND

- ▲ SLOPE
- * INDICATES INTERIM CONSTRUCTION
- PERMANENT FENCE
- - - TEMPORARY FENCE
- PROPERTY BOUNDARY
- SEDIMENTATION POND
- EMERGENCY SPILLWAY

FIGURE 3-3
PLOT PLAN SHOWING THE STABILIZED PILE
SOUTH SALT LAKE SITE

Construction at the site would begin with site preparation, including the following activities:

1. Preparation of the staging area.
2. Clearing of trees and brush.
3. Installation of the construction storm drainage system.
4. Excavation of the sedimentation basins.
5. Installation of a waste-water treatment system.

These activities are described in detail in Appendix A.

After site preparation, the following construction activities would proceed sequentially.

1. Demolition of foundations and rubble.
2. Excavation of tailings and contaminated materials.
3. Preloading to reduce risk from excessive differential settlement (see footnote to Table 1-1).
4. Placement of a liner system in the embankment area.
5. Placement of tailings and contaminated materials in the embankment area.
6. Placement of a cover system over the tailings and other contaminated materials.
7. Placement of fill to restore decontaminated areas to natural grade.
8. Revegetation of restored areas.

Each of these activities are described in detail in Appendix A, and are briefly described in the following paragraphs.

Demolition

Rubble, foundations, and the abandoned rail spur would be reduced in size and incorporated into the embankment. These materials would be placed in the lower portions of the embankment, above the post-remedial action ground-water level, in such a manner as to eliminate voids and to prevent settlement. Building foundations in the embankment area which would not interfere with the construction or integrity of the embankment would be left in place.

The water tower would be dismantled, decontaminated if necessary, and disposed of in a public landfill or sold as scrap.

Excavation of tailings and contaminated materials

Tailings would be dewatered. This would be accomplished in layers by scraping, trenching and drying, excavating the dewatered material until a new level is reached which is too wet for handling, and repeating the process. Excavation could alternate between sections of the site to allow for the drying process. Underlying contaminated clayey soils may not have sufficient strength to support scrapers. These materials, as well as one foot of the tailings above them, could be excavated with backhoes.

Excavation in the areas to be restored would be to the 15 pCi/g (Ra-226) limit. This is estimated to be two feet below the tailings/natural soil interface. Table 3-3 shows the volumes and types of excavations.

Dewatering water would be pumped from the excavation trenches and drained to the sedimentation basins for treatment prior to discharge.

Preloading (see note to Table 1-1)

After excavation and stockpiling of tailings and contaminated materials, 3,000,000 cy of noncontaminated material would be trucked in to cover the 53-acre disposal site with fill for preloading. The preload would stay in place for approximately 2.5 years (determination of the time would be based on field measurements of settlement to determine the amount and rate of settlement). Once settlement has slowed and the amount of settlement that would take place due to the construction of the embankment has taken place, 2,000,000 cy of the preload material would be hauled away for disposal. The remaining material would be used in the construction of the liner system and for fill around the site.

Liner system placement

The liner system would be placed as the embankment area tailings and contaminated materials are excavated. The system would consist of a compacted subbase of sufficient thickness to be above the post-remedial action ground-water elevation, a three-foot granular capillary break layer base, and two feet of compacted, fine-grained soil under the embankment area. A fleet of 35 trucks that contain about 18.5 cy, making 5 trips per day, could haul in the required 220,000 cubic yards of subbase material, 300,000 cubic yards of granular base material, and 190,000 cubic yards of liner material in 220 days (Table 3-3).

Placement of tailings and other contaminated materials

Tailings and other contaminated materials would be placed in controlled lifts in the embankment area. Tailings sands and slimes would be mixed during placement and compacted to form a dense, stable material. For purposes of reducing radon emissions and providing an upper capillary break, sandy tailings would be identified and incorporated into the upper portion of the embankment. The purpose of the upper capillary break would be to limit or eliminate upward migration of moisture-transported contaminants. The benefits of placement of sandy tailings in the upper portion of the embankment would outweigh the disadvantage of the slight increase of net infiltration into the tailings.

Placement of cover system

The cover would be constructed of two basic layers: a lower compacted earthen layer to act as a radon and water infiltration barrier and an upper

pit run rock layer for surface stability. A typical section through the embankment is shown in Figure 3-4. A fleet of 35 trucks (18.5 cy capacity) making 5 trips per day, would haul in the required 290,000 cubic yards of radon barrier material and 155,000 cubic yards of pit run rock in 140 days (Table 3-3). The cover materials would be dumped from the trucks, spread with dozers, and compacted.

Placement of restoration fill

During the relocation of contaminated material into the tailings embankment, large portions of the existing site would be excavated to below ground level. These areas would be restored with uncontaminated fill to the approximate elevation of the surrounding terrain and contoured to provide surface drainage. A fleet of 35 trucks with 18.5 cy capacity trailers, making 5 trips per day, would haul in the required 710,000 cubic yards of fill in 220 days (Table 3-3). The fill materials would be spread with dozers and compacted.

Revegetation

All areas of the site disturbed by the remedial action except for the embankment cover would be prepared and seeded with native grasses. Site preparation requirements (mulch and fertilizer) would be assessed after the fill material has been analyzed as a plant growth medium.

3.2.4 Alternative 3 preferred alternative--decontamination of the Vitro site and stabilization at the South Clive site

In this alternative, all tailings and contaminated material would be transported to the South Clive site, which is located on a section of state land about 85 miles west of Salt Lake City (Figure 3-5). There, they would be stabilized partially below grade on a 55-acre area in the northern part of the section. The location of this site was chosen to assure long-term isolation of the tailings while taking advantage of major transportation routes.

Before stabilization of the waste could begin, the 60 acres of the South Clive site would be withdrawn from state lands and permission obtained from the CVWRF Board to clean up the 128-acre Vitro site. The materials obtained in the cleanup of vicinity properties would be delivered to the Vitro site for transportation to the South Clive site for final stabilization.

There are two options to this alternative: transport of the tailings and contaminated materials by train or by truck. Each option is discussed separately as appropriate.

Table 3-3. Material volumes - stabilization on the Vitro site

Item description	Quantity cubic yards
Excavation	
Excavation of dry tailings (excavate with scraper)	170,000
Excavation of wet tailings (dewater and excavate with scraper)	1,380,000
Excavation of saturated contaminated materials (excavate with backhoe)	670,000
Rubble	80,000
Other contaminants	150,000
(Preload Sytem) ^a	(3,000,000)
Liner System	
Subbase	220,000
Base	300,000
Liner	190,000
Cover	
Radon barrier soil (silty sand)	290,000
Erosion barrier, ditches and perimeter road (pit run rock)	155,000
Restoration	
Select fill	710,000

^aSee footnote to Table 1-1

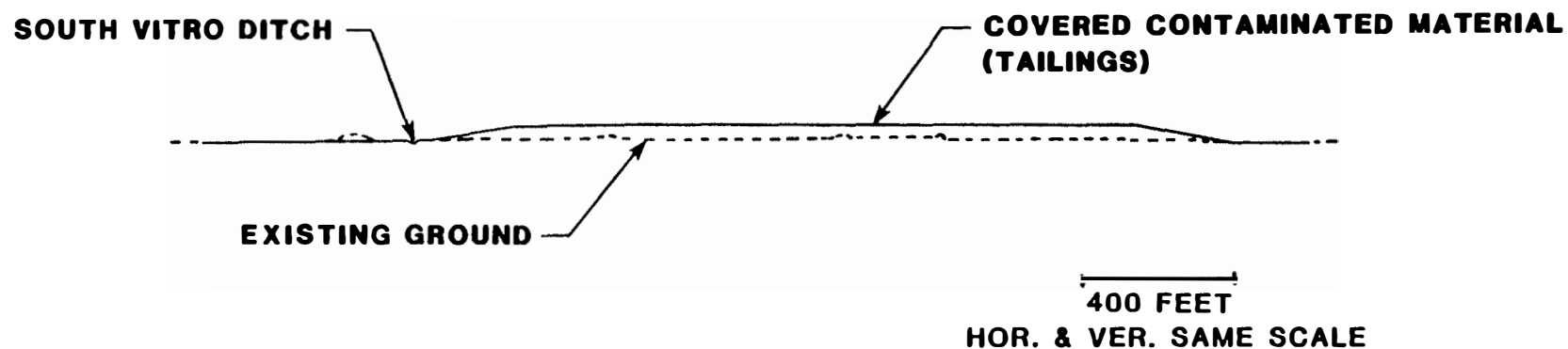
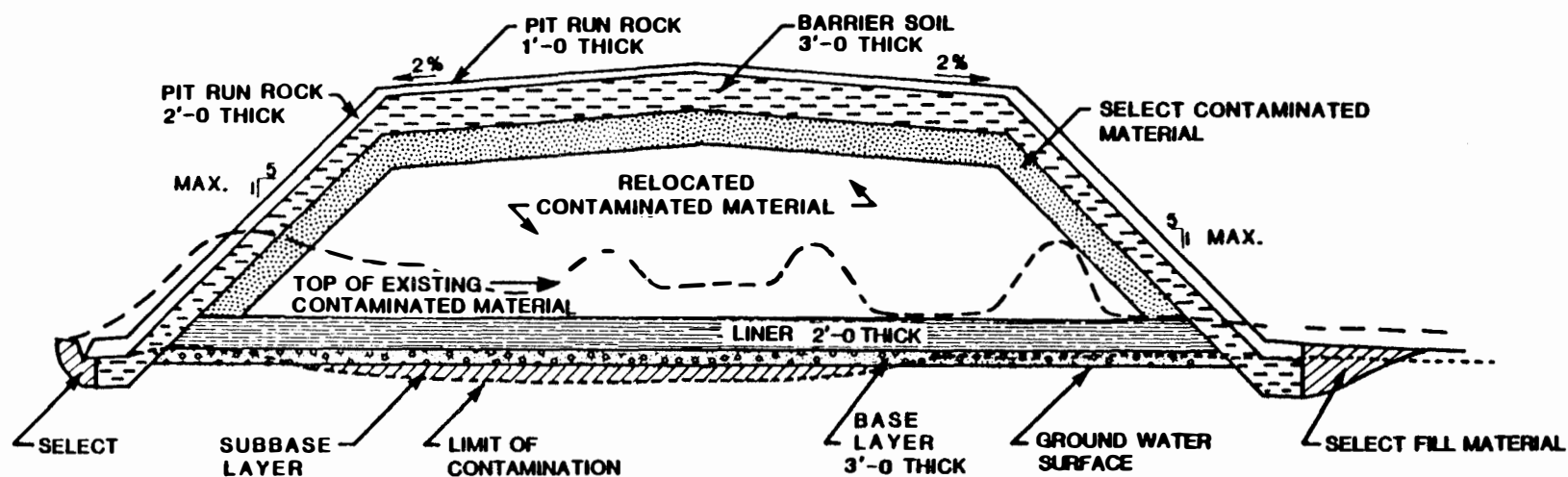


FIGURE 3-4
TYPICAL LINER AND EMBANKMENT SECTION
SOUTH SALT LAKE SITE

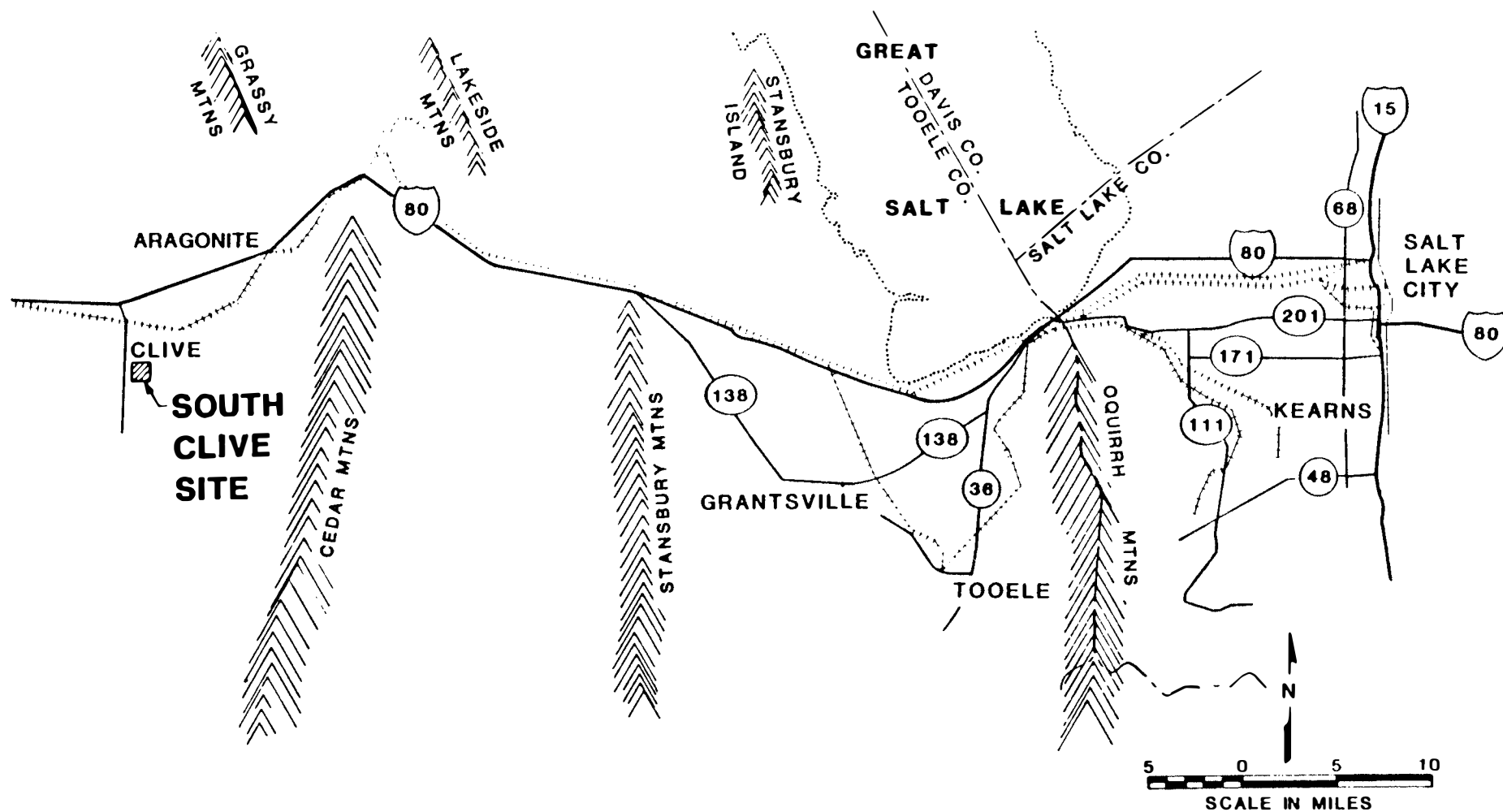


FIGURE 3-5
SOUTH CLIVE VICINITY MAP

Construction would begin with site preparation at the Vitro and South Clive sites, including the following activities (Figures 3-6 and 3-7):

1. Preparation of a staging area at each site.
2. Clearing of trees and brush.
3. Installation of a construction storm drainage system.
4. Excavation of the waste-water retention basins.
5. Installation of a waste-water treatment system at the Vitro site.
6. Installation of a dewatering system at the Vitro site.

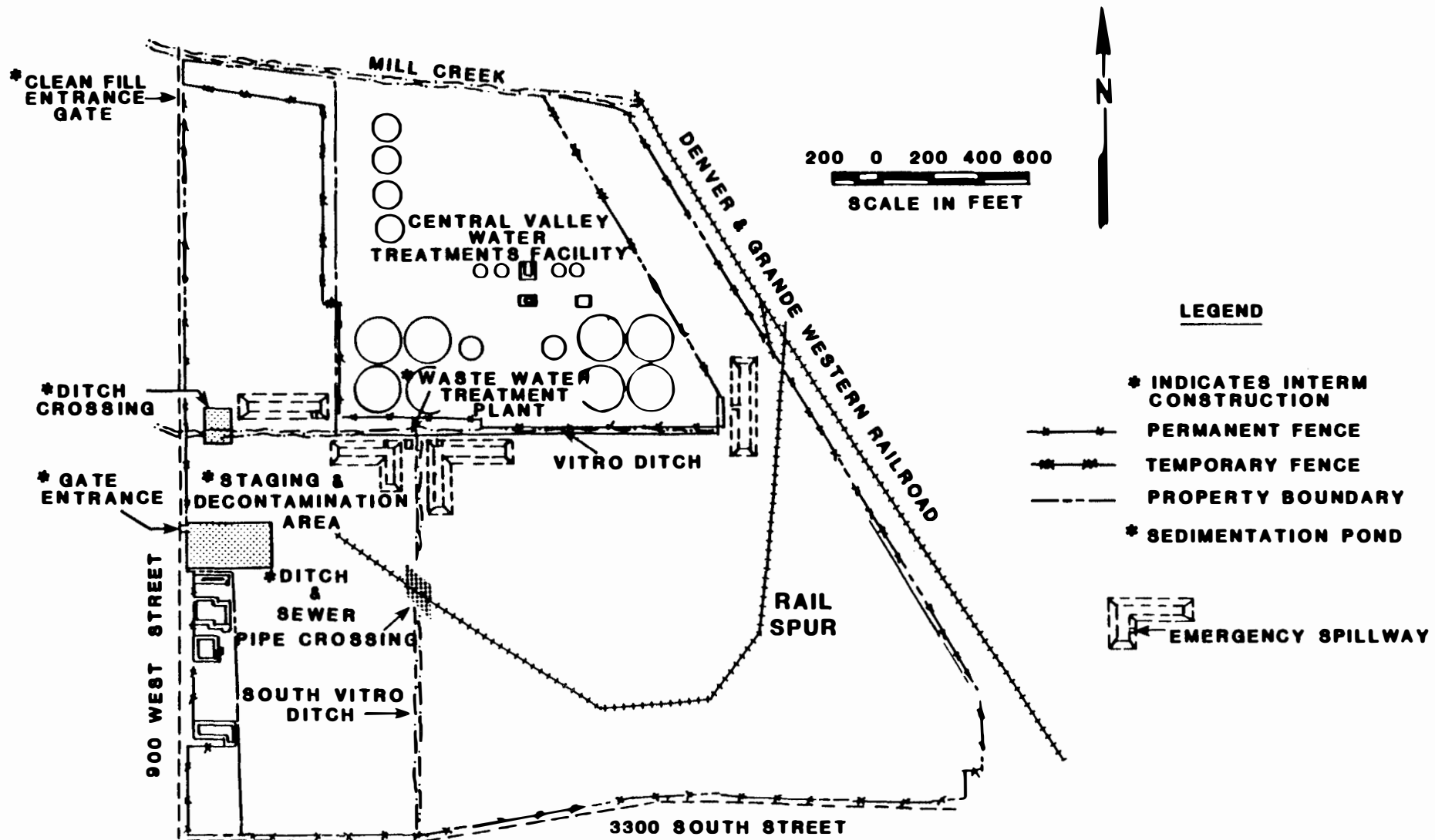
These activities are described in detail in Appendix A.

After site preparation, the following construction activities (train transport) would proceed sequentially:

1. Construction of a railroad loadout spur at Vitro and the railroad spur and unloading facilities at the South Clive site.
2. Construction of an access road from I-80 to the South Clive site.
3. Demolition of foundations and rubble.
4. Excavation of the disposal site and stockpiling of the soil for cover material.
5. Excavation and loading of tailings and other contaminated materials into train cars.
6. Unloading and placement of the tailings and contaminated materials into the South Clive embankment area.
7. Placement of a cover system over the tailings and contaminated materials.
8. Removal of the railroad spur and placement of fill at the Vitro site to restore decontaminated areas to natural grade.
9. Revegetation of restored areas.
10. Removal of the railroad spur and installation of a permanent fence around the South Clive embankment.

For the truck option, the following activities would proceed sequentially:

1. Construction of haul road from I-80 to the South Clive site.
2. Demolition of foundations and rubble.



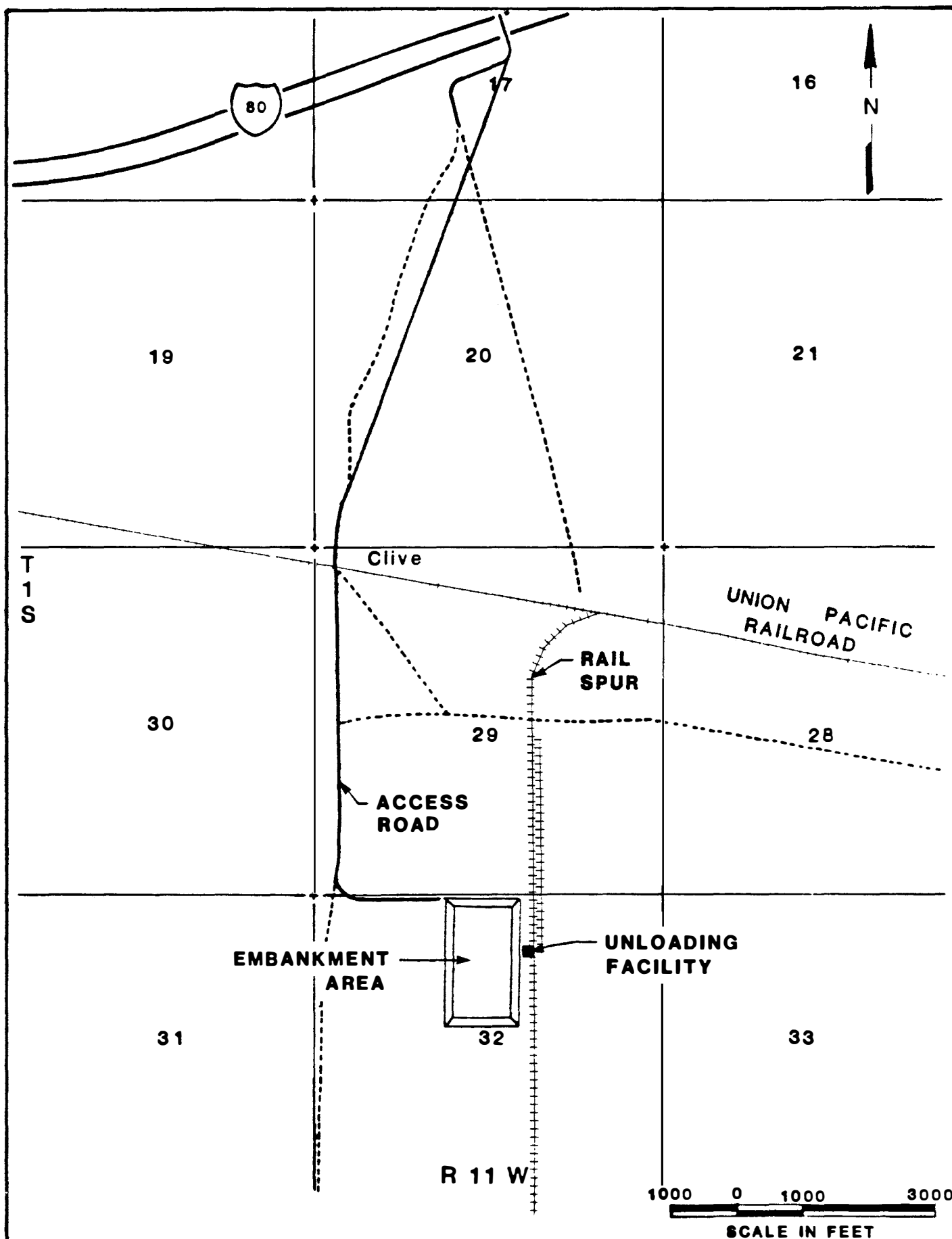


FIGURE 3-7
PLOT PLAN FOR SOUTH CLIVE

3. Excavation of the embankment area and stockpiling of cover material at the South Clive site.
4. Excavation and loading of tailings and contaminated materials into trucks.
5. Unloading and placement of the tailings and contaminated materials into the South Clive embankment area.
6. Placement of a cover system over the tailings and contaminated materials.
7. Placement of fill to restore decontaminated areas at the Vitro site to natural grade.
8. Revegetation of restored areas.
9. Installation of a permanent fence around the South Clive disposal site.

The major activities for each transportation option are briefly described in the following paragraphs and are documented in detail in Appendix A.

Construction of railroad spurs

For the train option, tailings and any contaminated subsoils would be excavated from an area 3,800 feet long and 120 feet wide to accommodate both the railroad and loading areas. The area would then be filled with clean subbase material and the ballast, ties, and tracks installed.

A railroad spur, 3,800 feet long will be installed, curving across the site from the northeast corner toward the southwest corner of the Vitro site.

Concurrently, a 13,800-foot-long railroad spur and run-around track would be constructed south from the Union Pacific mainline alongside the South Clive site and ending near the south edge of the site. Subbase would be excavated from the land alongside the track, compacted, and then the ballast ties and rails installed. Additionally, a roto-dumper and a rotating stacker would be installed to unload and stack the tailings and contaminated materials for final placement.

Construction of haul road to South Clive site

For the truck option, the existing access from the Aragonite exit from I-80 to the South Clive site will need to be resurfaced. About seven miles of the frontage road will need to be upgraded to carry 35-ton loading; additionally, 2.7 miles of new, two-lane gravel road will be constructed from the frontage road to the South Clive site.

For the train option, a vehicle access road (2.7 miles, two-lane gravel) will be constructed from the frontage road to the site. Frontage road will also be upgraded and maintained for light-duty traffic.

Demolition

Rubble, foundations, and the abandoned rail spur would be reduced in size and transported by either side-dump railroad cars or dump trucks and incorporated into the embankment. These materials would be placed in the lower portions of the embankment in such a manner as to eliminate voids and to prevent settlement.

The water tower would be dismantled, decontaminated if necessary, and disposed of in a public landfill or sold as scrap.

Excavation of tailings and contaminated materials

Tailings would be dewatered. This would be accomplished in layers by scraping, trenching and drying, excavating the dewatered material until a new level is reached which is too wet for handling, and repeating the process. Excavation could alternate between sections of the site to allow for the drying process. In some areas, the underlying contaminated clayey soils may not have sufficient strength to support scrapers. These materials, as well as one foot of the tailings above them, could be excavated with backhoes.

The excavated material would be loaded into either the trains or trucks and transported to the South Clive site. Two unit trains, each of 54 cars, or 77 trucks are required to relocate 5,400 tons of tailings per day.

Excavation in the areas to be restored would be to the 15 pCi/g (Ra-226) limit. This is estimated to be two feet below the tailings/natural soil interface. Table 3-4 shows the volumes and types of excavations.

Dewatering water would be pumped from the excavation trenches and drained to the sedimentation basins for treatment prior to discharge.

Unloading and placement of tailings and other contaminated materials

For the train option, the unit train will be pushed through a roto-dumper which will unload the cars into a conveyor leading to a rotary stacker. Rubble will be unloaded from the side dump cars in an area just to the south of the roto-dumper. Scrapers or trucks will then be used to move the tailings and contaminated materials to the final location in the embankment. If the truck option is selected, the tailings and contaminated materials will be dumped directly in the embankment area to be spread by scrapers.

Tailings and other contaminated materials would be placed in controlled lifts in the embankment area. Tailings sands and slimes would be mixed during placement and compacted to form a dense, stable material. For purposes of reducing radon emissions and providing an upper capillary break, sandy tailings would be identified and incorporated into the upper portion of the embankment.

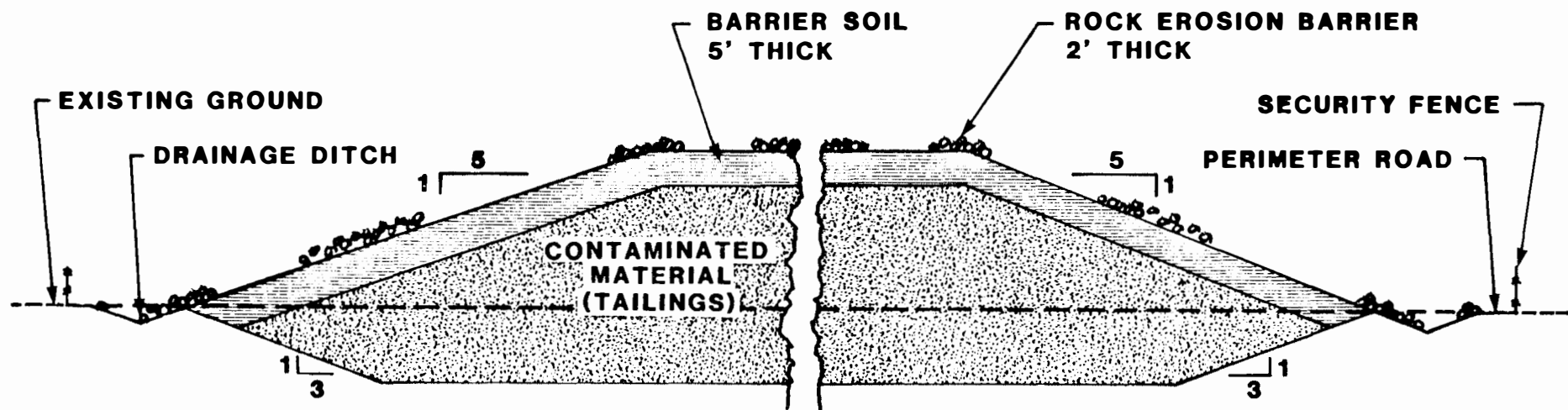
Table 3-4. Material volumes - relocation to South Clive

Item description	Quantity cubic yards
Excavation	
Excavation of dry tailings (excavate with scraper)	170,000
Excavation of wet tailings (dewater and excavate with scraper)	1,380,000
Excavation of saturated contaminated materials (excavate with backhoe)	670,000
Rubble	80,000
Other contaminants	150,000
Cover	
Radon barrier soil (silty sand)	460,000
Erosion barrier, ditches and perimeter road (pit run rock)	202,000
Restoration	
Select fill	1,040,000

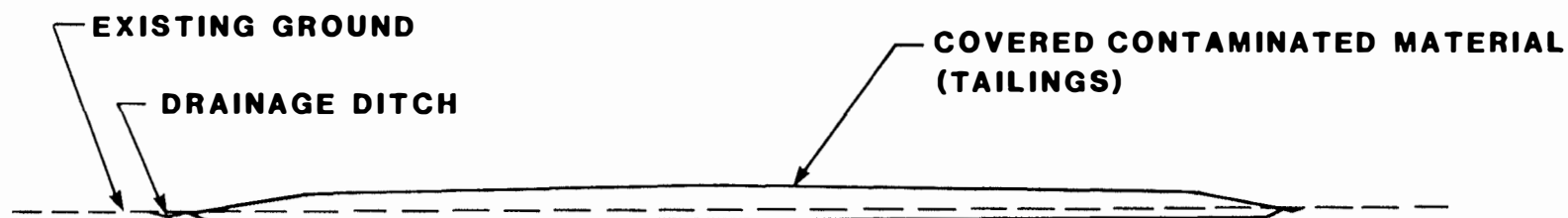
Placement of cover system

The cover would be constructed of two basic layers: a lower compacted earthen layer to act as a radon and water infiltration barrier and an upper pit run rock layer for surface stability. A typical section through the embankment is shown in Figure 3-8.

The soils for the earthen layer would be stockpiled during excavation of the disposal area and would be placed in controlled lifts with the completion of each section of the embankment. The 460,000 cubic yards of cover would be placed by scrapers and dozers and compacted. The 202,000 cubic yards for the 2-foot-thick pit run rock layer would be handled by three 20.5 ton trucks and trailer rigs from a quarry in the nearby mountains in 640 days, making 8 trips per day.



NO HORIZONTAL OR VERTICAL SCALE



HOR. & VER. SAME SCALE

FIGURE 3-8
TYPICAL SECTION OF THE EMBANKMENT
SOUTH CLIVE SITE

Placement of restoration fill

During the relocation of contaminated material to the South Clive tailings embankment, large portions of the existing site would be excavated to below ground level. These areas would be restored with uncontaminated fill to the approximate elevation of the surrounding terrain and contoured to provide surface drainage. For the truck option, a fleet of 19 trucks and trailers would haul in the required 1,040,000 cu yds of fill (Table 3-4) by making 5 trips a day for 625 days. The train option would require 945,000 cu yds of fill to be hauled in since 95,000 cu yds would be placed during the construction of the railroad spur. After the track is removed, 17 trucks would be required to deliver this reduced volume making 5 trips per day for 625 days. The fill material would be spread with dozers and compacted.

At the South Clive site, restoration is required for the train option to backfill the roto-dumper and rotary stacker area. Excess cover material that was excavated during the embankment construction will be spread in these areas with dozers and compacted. The spur line would be removed and the R.O.W. graded to conform with the adjacent land.

Revegetation

All disturbed areas of the Vitro and South Clive sites disturbed by remedial action, except for the embankment area, would be prepared and seeded with native grasses. Site preparation requirements (mulch and fertilizer) would be assessed after the fill material has been analyzed as a plant growth medium. For the train option, the spur line R.O.W. from the South Clive site to the mainline would also be revegetated.

3.2.5 Alternatives eliminated from further consideration

Four classes of remedial-action alternatives were identified but eliminated from further consideration as not reasonable for one or more of the following reasons: the alternatives were obviously inferior to the considered alternatives in both their cost effectiveness and environmental benefits; the alternatives were sufficiently similar to the considered alternatives as to make detailed consideration of them superfluous; the alternatives were contrary to the EPA standards or the NRC's expressed guidelines for uranium mill tailings disposal as these guidelines were understood in 1981. These considered-but-rejected alternatives and reasons for their rejection are discussed in the sections that follow and, in more detail, in Appendix C.

3.2.5.1 Stabilization at other state-nominated locations

The State of Utah nominated three areas for the long-term disposal of tailings and residues from the Vitro site (VTSSC, 1980). One of these areas was the South Clive site; the other two areas were the "great depression" located about 8 miles north of Clive, Utah, and a section of state land located approximately 3 miles west of Delle (Tooele County), Utah (see Figure 1-3). Both of the latter two areas were found to be less desirable from a

geotechnical point of view and had drawbacks relative to transportation in that direct access to them from convenient rail drop-off points would require the crossing of I-80 at points distant from overpasses on that highway. The need for an intermediate transport step (by truck from rail drop-off points to the site) and the need for new road construction would make these two areas more costly as disposal sites than the South Clive site. In addition, they ranked lower in terms of overall environmentally desirable characteristics for a waste-disposal site than the South Clive site. Accordingly, the DOE determined that these sites did not represent reasonable alternatives.

3.2.5.2 Stabilization in eastern Utah

Two areas in eastern Utah were also examined as disposal areas. One area is about 3 miles north of Woodside, Emery County, Utah and about 156 road miles from Salt Lake City. The other is 9 miles south of Crescent Junction, Grand County, Utah, about 215 road miles from Salt Lake City. Both areas appear to be geotechnically acceptable. The Woodside area is typical of the two and is discussed below.

Consideration was given to the Woodside area in response to a proposal submitted to the State of Utah recommending the use of an existing fleet of trucks that currently (1980) haul coal from Emery and Carbon County areas to the Kennecott copper mill near Salt Lake City. The trucks normally return empty to the Woodside area, so it was suggested that they could be diverted to the Vitro site and loaded with tailings for the return trip. The DOE evaluated this proposal and found that it would require 9 years to move the tailings in this way, and at a cost of \$14.09 per ton (truck transport to the South Clive area would cost \$8.50 per ton). Thus, this alternative would be neither cost effective nor timely relative to the considered alternatives; accordingly, it was determined to be an unreasonable alternative by the DOE.

3.2.5.3 Stabilization at other locations in Salt Lake Valley

The DOE examined the alternative of moving the Vitro tailings to other locations within the Salt Lake Valley and concluded that, relative to stabilization at the Vitro site, there would be no clear economic or environmental benefits to be realized in such a move unless the new locations afforded special opportunities for isolation and reduction of remedial-action costs. Examples of such alternatives would be the stabilization of the wastes in some large, isolated public construction project such as highway interchanges or airport runways. However, no such opportunities were known to be available or foreseen to be available, and so no reasonable alternatives in this category were identified by the DOE. Other such alternatives are discussed in Appendices B and C.

3.2.5.4 Reprocessing of the Vitro tailings

The DOE is required by the UMTRCA, Title I, to determine the practicability of reprocessing the Vitro tailings. Since the final determination of practicability has not been made, this class of alternatives cannot be entirely rejected at this time. However, preliminary studies show that reprocessing of the Vitro tailings is not economic at present-day prices for

uranium (see Section C.4, Appendix C). Using what would currently be the most economical process (heap leaching) and reprocessing the tailings on the site, a firm would incur a net loss on the order of \$23 million at present-day uranium and vanadium prices. This loss would be in addition to the cost of stabilizing residues from reprocessing. Therefore, the reprocessing alternatives have been considered as being unreasonable for purposes of this document. Should these alternatives become practicable in the near future, DOE will examine the need for a supplement to the EIS.

3.3 ENVIRONMENTAL IMPACTS

In this section attention is focused on the principal environmental impacts of the three alternatives studied. A tabular comparison of all impacts is presented in Table 1-3.

3.3.1 Comparison of impacts

Radiological impacts are foremost among the public's concerns. Alternative 1 would perpetuate the present situation; an estimated 0.6 additional cancer deaths would occur in a three-year period in the Salt Lake Valley. Either Alternative 2 or Alternative 3 would reduce this toll. In Section F.3.1 of Appendix F it is conservatively assumed that radon is being emitted from the surface of these tailings at an areal flux of 560 picocuries per square meter per second ($\text{pCi/m}^2\text{s}$). Either of the latter two alternatives would reduce this flux to the EPA standard. The estimated number of excess lung cancers would be similarly reduced. During the 3-year time taken for the remedial action this flux will be gradually reduced, either because (in Alternative 2) the tailings are stabilized under an earthen cover or because (in Alternative 3) the tailings are actually hauled away. The levels of contaminated dust would increase because of excavation and loading of the tailings; however, calculations show that this source of radiation exposure would be about a hundred-fold less important than the radon exposure. The potential radiation exposure of the public during remedial action is estimated to be 15,000 manrem for both alternatives; both would result in an additional estimated 0.3 deaths from cancer. The workers themselves would have the largest individual exposures of all persons. It is estimated that they would receive doses of about 6 rem apiece during the 3 years of remedial action.

Alternative 1 would have no effect on existing air quality in Salt Lake or Tooele Counties. The impacts of Alternatives 2 and 3 on air quality would be short-term in each case; the combustive emissions from construction activities in Alternatives 2 and 3 would be within limits allowed by the State of Utah. However, particulate emissions during Alternatives 2 and 3 would exceed Federal primary and secondary air quality standards.

There would be no impact on topography or soils under Alternative 1. In Alternative 2, a permanent, smoothly-contoured pile about 50 feet high would be constructed on 53 acres in the southeast portion of the Vitro site and the remaining 75 acres of the site would be leveled to local grade; about 1.9 million cubic yards of soil, gravel, and clay would be imported from

commercial sources to complete this alternative. In Alternative 3, all 128 acres of the Vitro site would be returned to local grade, requiring about 1.0 million cubic yards of imported soil for backfill. A permanent, smoothly-contoured mound 34 feet high would cover 55 acres at the South Clive site; about 647,000 cubic yards of gravel or crushed stone would be imported to provide an erosion-resistant cover for this mound.

EPA water standards would be met by either Alternative 2 or Alternative 3. However, Alternative 2 would rely on an engineered barrier, natural materials, and maintenance of the existing pressure gradients in the hydrologic system beneath the tailings to protect the potable confined aquifer and the potable lower portion of the unconfined aquifer. Alternative 3 would simply remove the tailings as a potential source of contamination at the Vitro site and place it in an area of poor-quality, shallow ground water. In Alternative 1, the potential for contamination of surface water and ground water would continue.

Alternative 1 would have no effect on existing ecosystems at the Vitro site or the South Clive site. In Alternatives 2 and 3, the small biotic community on the 128-acre Vitro site would be destroyed; about 200 acres of desert scrubland and associated habitat at the South Clive site would also be disturbed or destroyed in Alternative 3.

Next to radiological impacts, the impacts on land use would be the most important. Alternative 1, leaving the present situation unchanged, would mean that the CVWRF Board might be constrained in expanding the capacity of the sewage-treatment plant to 100 million gallons per day (mgd), because its plans require the use of land now covered with tailings. Alternative 2, though it would leave 53 acres covered with tailings, would free 75 acres for the CVWRF Board to use. Alternative 3 would free all of the land for CVWRF Board use.

Alternatives 1 and 2, as now formulated, would not require the acquisition of a 5.4-acre industrial strip on the southwest side of the Vitro site.

Removal of the tailings from the 128-acre Vitro site would permit development in accordance with the CVWRF's approved Master Plan. In 1979, the CVWRF bought approximately 29 acres of frontage property along 3300 South Street from Richards-Moench for \$62,500 per acre. This land was purchased under the assumption that the federal government would remove the tailings and make the land available to the CVWRF. The CVWRF Board has stated that it will develop a temporary industrial park on the 3300 South Steet frontage property if Alternative 3 is the adopted remedial action. Based on an analysis of the economic impacts of the remedial action options, it is estimated that the development of a temporary industrial park would generate approximately \$11.0 million a year in gross economic benefits to the region. Alternative 2, which would make approximately 75 acres available to the CVWRF, may permit a portion of the proposed development set forth in the CVWRF's approved Master Plan. To the extent a temporary industrial park is developed on the property, a regional economic benefit also would result under Alternative 2.

Alternative 1 would produce no construction-intensive impacts such as those on populations and employment, transportation networks, energy-consumption patterns, and occupational health and safety. Alternatives 2 and 3 would produce relatively minor and similar impacts in all of these areas.

Alternative 2 would create short-term (at most, 2.5-year) jobs for a maximum of 104 construction workers. The income and taxes from these jobs would have little effect on the Salt Lake City economy and social infrastructure. Transportation networks in Salt Lake County would not be seriously affected by Alternative 2; at most, there would be a 8.5 percent increase in traffic on 5400 South Street owing to deliveries of soil; increases in traffic along the remainder of the haul route would be less. About 2.5 million gallons of diesel fuel and 0.4 million kilowatt hours of electrical power would be expended in the implementation of Alternative 2. According to recent incidence rates, one should expect 0.015 fatal work accidents and about 12 disabling injuries during the 2.5-year term of Alternative 2.

Alternative 3 would create a maximum of 130 (train) or 153 (truck) short-term construction jobs in Salt Lake and Tooele counties. Again, the jobs created by Alternative 3 would have little effect on the Salt Lake County economy although there could be small-but-measurable effects in Tooele County. The effects of Alternative 3 along the haul routes to the Vitro site would be less (maximum increase of 4 percent) than those of Alternative 2. About 7 million gallons of diesel fuel and 0.8 million kilowatt hours of electrical power would be expended in the implementation of Alternative 3--more than 2 times the energy expenditures of Alternative 2. Finally, one should expect a few more occupational accidents in Alternative 3 than Alternative 2 because of the larger work force involved: according to 1980 incidence rates, 0.014 (train) or 0.52 (truck) fatal work accidents and 27 (train) or 25 (truck) disabling injuries should be expected.

The final matter in which there is a great difference among the alternatives is cost. It is indicated in Appendix A that Alternative 2 would cost \$31.24 million in 1983 dollars; Alternative 3 would cost between \$63.78 (train) and \$67.68 (truck) million.

3.3.2 Mitigating measures

The potential environmental impacts from remedial-action alternatives could be made smaller through the use of appropriate mitigating measures. A number of these have been incorporated into the plans for Alternative 2 and Alternative 3. These include dust control, material containment, rail car or truck washdown, elimination of public access to the sites, and the provision, where necessary, of protective equipment for use by remedial action workers. Additional measures are described in Section 5.19.

There are even mitigating measures possible for Alternative 1. The cleanup of vicinity properties is already under way. Other measures, which depart somewhat from strict no action and which would not bring the site into conformity with the EPA standards, but which would improve the present

situation, include: (1) fencing and posting the property to keep people off it and to prevent further off-site uses of contaminated material, (2) sprinkling to control dust, and (3) covering with a sufficient layer of soil to support vegetation and thus to reduce further wind and water erosion.

In Alternative 2, stabilization at the Vitro site, a possible mitigation measure would be a land exchange. One of the possibly serious consequences of this alternative is that it would interfere with the plans of the CVWRF board to expand the capacity of their sewage treatment plant by taking away land the board was planning on using. The State of Utah could acquire vacant land adjacent to the Vitro site and transfer it to the CVWRF board in exchange for the 53 acres used for the stabilization area and not available to the board. The board would still have to adjust its present plans, but would be less land-limited in doing so.

3.3.3 Summary of major impacts

Alternative 1 would leave unchanged the present unacceptable level of radiation exposure to the people of Salt Lake Valley. Thus, Alternative 1 would not meet the EPA standards; either of the other two alternatives would. For this reason alone, Alternative 1 is unacceptable.

Alternative 1 would completely interfere with the expansion plans of the CVWRF Board. Alternative 2 would free more than half of their land for use in expansion. Alternative 3 would free all of it.

Alternative 1 would result in the continued contamination of surface and ground waters. Either Alternative 2 or 3 would meet the EPA standards. Alternative 2 would raise the tailings out of the ground-water system and retard movement of contaminants from the tailings to the ground water for a long period of time. Alternative 3 would eliminate the possibility of future ground-water contamination at the Vitro site.

The direct monetary cost of the remedial-action portion of Alternative 1 would be zero, that of Alternative 2 would be 31.24 million, and that of Alternative 3 between \$63.78 and \$67.68 million. The estimated remedial action costs for the train and truck transportation mode for Alternative 3 differ slightly. However, due to the conceptual nature of the design and the accuracy of the associated estimates, the costs for either transportation mode, should be considered essentially equivalent.

REFERENCES FOR CHAPTER 3

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- DOE (U.S. Department of Energy), 1982b. Environmental Assessment of Preliminary Cleanup Activities at Offsite Properties Contaminated by Tailings from the Inactive Uranium Mill Site Near Salt Lake City, Utah, DOE/EA-0186, Washington, D.C.
- EPA (U.S. Environmental Protection Agency), 1982. Environmental News, Office of Public Affairs, December 15, promulgated January 5, 1983, 48FR590.
- EPA (U.S. Environmental Protection Agency), 1980. Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, EPA 520/4-80-011, Washington, D.C.
- FBDU (Ford, Bacon and Davis Utah Inc.) 1981. Engineering Assessment of Inactive Uranium Mill Tailings, Vitro Site, Salt Lake City, Utah, DOE/UMT-0102, prepared for U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico 87115.
- VTSSC (Vitro Tailings Site Selection Committee), 1980. "Vitro Tailings Site Selection Committee Report," dated June 20; signed by Blaine N. Howard (Chairman), Earl Peirce, Fitzhugh Davis, Dan Blake, Robert Cunliffe, and Dane Finerfrock; copies available on request to Uranium Mill Tailings Remedial Action Project Office, DOE Albuquerque Operations Office, Albuquerque, New Mexico.

4 AFFECTED ENVIRONMENT

Described in this chapter are those features of the existing environment that may be affected by the alternative remedial actions discussed in Chapter 3.

4.1 REGIONAL SETTING

The region potentially affected by the alternatives under consideration consists of Salt Lake and Tooele counties in Utah. These two counties are very different. Salt Lake County is heavily urban; less than 0.9 percent of the 1980 population lived in rural areas. Nearly 63 percent of Salt Lake County is privately owned, and 6.7 percent of its land area is residential.

In contrast to Salt Lake County, 82.6 percent of Tooele County's land area is Federally owned and over 28 percent of the county's population is rural. The county population is largely concentrated in Tooele City, Grantsville, and Wendover. The vast majority of the 4.43 million acres in the county is arid open rangeland. It is characterized by broad, flat basins and old lake bed deposits occasionally interrupted by small mountain ranges.

4.2 DESCRIPTION OF THE AFFECTED AREAS

4.2.1 The Vitro site and surroundings

The Vitro site covers an area of approximately 128 acres. It is located about 4 miles south-southwest of the center of Salt Lake City, just northeast of the street intersection of 3300 South and 900 West. Figures 3-1 and 3-2 are, respectively, a map and a plot plan that show the general site area. The adjacent developed land to the northern-center of the site is the Central Valley Water Reclamation Facility (CVWRF) sewage-treatment plant No. 1. The entire Vitro site is presently owned by the CVWRF Board. Land-use patterns in the vicinity of the Vitro site are shown in Figure E-2 of Appendix E.

Tailings storage was in the western and southern portions of the Vitro site and included three impoundments referred to as the northwest, southwest, and southeast tailings areas (see Figure 3-2). The southwest and southeast areas are divided by the South Vitro Ditch which contains slow moving surface water. The Vitro Waste Ditch carries treated water from the CVWRF plant and divides the northwest and southwest tailings areas. Three surficial variations occur within the tailings areas. First and most obvious is the standing water in the northwest area where approximately 13 acres are covered with sludge from the CVWRF sewage-treatment plant. The quantity of sludge is estimated to be in excess of 6000 cubic yards (cy). The second variation consists of the excavated pit, approximately 10 feet deep and 600 feet long,

which is located in the northern half of the southwest tailings area. Material excavated from the pit is piled approximately 20 feet high along its edges. Water is standing in the bottom of this excavation, showing the elevation of the local water table. The third noticeable feature is the abundance of concrete debris in the southeast tailings area. This material was used during earlier attempts at stabilization (FBDU, 1981).

The eastern portion of the Vitro site was used for the ore processing mill, ore storage, and transportation. The buildings were removed but various foundations and concrete supports were left in place or buried on the site. This portion of the site remains at approximately natural ground-surface level where existing structures include a water tower and railroad tracks. At present, off-site cleanup projects are importing contaminated material onto the southeast tailings and stockpiling it in a fenced, low-lying area. Some of the imported material is concrete rubble, but for the most part it is sandy tailings that were originally taken from the site and used as fill. It is estimated that the total quantity of off-site material that will be stockpiled at the Vitro site is approximately 150,000 cy. This includes off-site wind-blown material that will be recovered from areas immediately surrounding the site.

The generally sparse vegetation includes grasses and herbaceous plants. Surface drainage is poor to nonexistent with several seasonal ponds on the tailings surface. Surface elevations within the site range between 4235 and 4250 feet above sea level.

The Vitro site contains an accumulation of a variety of materials. Besides the sludge and rubble mentioned above, the tailings areas include uranium tailings, vanadium tailings, and embankment materials. Material for dikes was excavated initially from within the projected impoundment areas. The average depth of excavation was on the order of 4 feet below the surrounding grade. Available information indicates that the tailings were not deposited uniformly within the impoundment areas. The nonuniformity reflects changes in the refining process, the variety of ore sources, and differential sorting of particle sizes from the discharge point. The northwest area primarily contains relatively clean medium and fine sands while the southwest area includes a high proportion of slimes and was not as deeply excavated. The southeast area contains the bulk of the tailings with occasional zones of cinders. These tailings grade from predominantly fine sands on the east to slimes on the west. The berms surrounding the tailings are composed of loose, medium-fine sands with some tailings contamination. Materials within the tailings ponds are generally slimes or silty sands. The slimes are fine-grained soils primarily of silt sizes, with little material in the clay-size range. The slimes are slightly plastic in the moist state and retain a considerable amount of fluid. Dry densities are low for both the slimes and the sands; however, the sands are much drier (MSRD, 1982).

4.2.1.1 The 5.4-acre industrial tract

The 5.4-acre industrial tract adjacent to the southwest side of the Vitro site is shown in Figure 3-2. It consists of six separately owned tracts: (1) less than one acre owned by Pey Development Co.; (2) an approximately 1-acre tract on the north end of the strip owned by WON-DOOR Corporation; (3) an approximately 1-acre tract south of tract (1) that is owned by Harrington & Co.; (4) an approximately 1-acre tract south of tract (3) that is owned by Abel and Sarah Paulsen; (5) an approximately 0.5-acre tract south of tract (4) that is owned by Blaine and Verla Berrett; and (6) a 2.2-acre tract south of tract (5) that is owned by Steve and Helen Pappas.

These six tracts are zoned for industrial use and three of them have been included in the DOE's list of properties eligible for remedial action under the vicinity property cleanup program. The buildings and land on this 5.4-acre strip are contaminated by windblown tailings and the buildings would require some excavation and reconstruction in order to meet the EPA standards for cleanup of structures; similarly, the open lands within the 5.4-acre strip would require excavation in order to meet EPA standards. These cleanup activities would cause a temporary loss of jobs for no more than a dozen people (DOE, 1982).

Other details of the area surrounding the Vitro site are supplied in Appendix E and in the engineering assessment (FBDU, 1981).

4.2.2 The South Clive site and surroundings

The proposed disposal site near Clive, Tooele County, Utah is located approximately 65 miles in a straight-line distance due west of Salt Lake City and consists of the 1-square-mile area designated as Section 32, Township 1 South, Range 11 West. The northern boundary of the site area is approximately 1 mile south of Clive which is a railroad siding for the Union Pacific System. The railroad right-of-way servicing this siding extends from the Salt Lake City area westward toward Nevada. Highway access to the site is provided by U.S. Interstate 80 which passes approximately 2.5 miles to the north of the site. A dirt trail intersects the highway north of Clive, extends in a southerly direction, and runs along the site's western boundary.

As shown in Figures 3-5 and 3-6, the site is located within a relatively flat topographic area along the eastern edge of the Great Salt Lake Desert. The desert area extends for approximately 60 miles from the Nevada-Utah border on the west to a series of north-south trending mountain ranges on the east. In the vicinity of the site, the eastern border of the desert is formed by the Cedar Mountains which rise to elevations on the order of 7700 feet (approximately 3500 feet above the desert floor). The proximity of this mountain range results in a surficial drainage pattern for the site which is generally in a westerly direction.

The site has minimal topographic relief with a slight downward gradient that is relatively uniform toward the southwest (see Figure 3-7). The maximum relief within the square-mile area is on the order of 11 feet. Vegetation across the site is sparse and is typical of semi-desert low shrubland.

4.2.3 The transportation corridors

The train transportation corridor is the western district of the Union Pacific System route that more or less follows I-80 to the west of Salt Lake City (see Figure 3-5); more specifically, it is the railroad right-of-way bordering the route to be taken by trains from the Vitro site to within a mile of the South Clive site. The length of this corridor is approximately 85 miles. It begins at the Roper Railroad Yard on the east side of the Vitro site and runs northward to where the Rio Grande Railroad merges with the Union Pacific System at about 3rd West and I-80 in Salt Lake City. The Union Pacific System maintains the remaining portion of the corridor that would run to an unloading point at Clive, from which a rail spur would be constructed to the South Clive site.

The truck haul route between the Vitro and South Clive sites would use 900 West, 2100 South, and I-80 to the Aragonite exit. From there, trucks would follow the frontage road to the Clive overpass and then follow the improved county road to the site.

4.3 CLIMATE

The project region is in the Intermountain Plateau climatic zone that extends between the Cascade-Sierra Nevada Ranges and the Rocky Mountains and is classified as a middle-latitude dry climate or steppe. The climate is characterized by hot and dry summers, cool springs and falls, and moderately cold winters.

4.3.1 Weather patterns

Mountain ranges tend to restrict the movement of weather systems into the two-county area, but the area is occasionally affected by well-developed storms in the prevailing regional westerlies. The mountains act as a barrier to frequent invasions of cold continental air. Precipitation is generally light during the summer and early fall and reaches a maximum in spring when storms from the Pacific Ocean are strong enough to move over the mountains. During the late fall and winter months, high pressure systems tend to settle over the area for as long as several weeks at a time. Under these conditions, smoke and haze accumulate in the lower levels of the stagnant air, frequently becoming associated with fog and obstructing visibility. Aside from the altitude and the mountains, the most influential natural condition affecting

the regional climate is the Great Salt Lake. This large inland body of water, which never freezes over because of its high salt content, tends to moderate downwind temperatures.

The local weather varies among the Vitro site, the transportation corridors, and the South Clive site. The Vitro site is semi-arid while the South Clive site is arid desert. The transportation routes encompass the transition between the two. Each of these areas is discussed in the following sections.

4.3.2 Temperature

Data from the Wendover meteorological station (about 50 miles due west of the South Clive site) suggest that temperatures at the South Clive site are similar to but slightly warmer than those at the Vitro site. The extreme temperatures have ranged from -19 to 112°F. Normal monthly temperatures have ranged from 27.4°F in January to 79.3°F in July, with an annual average of 52.2°F. The daily normal minimums ranged from 18.8 to 66.6°F for January and July, respectively, while the normal daily maximums ranged from 36 to 92°F for the same months.

According to U.S. Weather Bureau records for Salt Lake City, from 1928 to 1978 the extreme temperatures near the Vitro site should have ranged from -30 to 107°F. The normal monthly temperatures (1941-1970) ranged from 28°F in January to 76.7°F in July, with an annual average of 51°F. The normal daily minimums for January and July have been 18.5 and 60.5°F, respectively, while the normal daily maximums for the same months were 37.4 and 92.8°F, respectively.

Temperatures for the transportation corridors would not differ significantly from those at the two sites. The only notable difference would be a slight reduction in extreme high temperatures at higher altitudes along the corridors.

4.3.3 Precipitation

Less precipitation occurs at the South Clive site, which is on the eastern edge of the Great Salt Lake Desert, than at the Vitro site. Normal annual precipitation at the Wendover meteorological station, which is here taken to be typical of the South Clive site, is only 4.88 inches. The lowest normal monthly precipitation is 0.29 inches in January, while June has the highest with 0.73 inches.

The climate at the South Clive site is arid, which means that evapotranspiration is at least five times precipitation. The climate of Salt Lake City is semi-arid, which means that the evapotranspiration-to-precipitation ratio is 5 or less (Weaver and Clements, 1938).

The maximum recorded 24-hour precipitation at Wendover was 1.33 inches and the maximum monthly precipitation was 3.01 inches. No precipitation in a month's time has been recorded many times. Snowfall is light; the maximum monthly amount recorded in 35 years was 14.6 inches in January; all other monthly maximums have been less than 10 inches. The maximum 24-hour snowfall was 8.5 inches in February of 1967, which is also the highest monthly total on record for February.

On the basis of weather records for Salt Lake City, precipitation at the Vitro site should be greater than at the South Clive site. The normal annual precipitation for Salt Lake City is 15.17 inches, with a normal monthly high of 2.12 inches in April and monthly low of 0.70 inches in July. Annual precipitation usually varies between 10 and 20 inches. The maximum monthly total in 50 years was 4.90 inches and occurred in April 1944. Months with no precipitation have been recorded but are rare. The maximum 24-hour amount recorded was 2.41 inches in April 1957. The Salt Lake area has received annual snowfall amounts ranging from less than 20 to 117 inches, with an average of 58.5 inches. A maximum 24-hour snowfall of 18.1 inches was recorded in December 1972.

Precipitation data for the transportation corridors are not available but precipitation probably decreases with distance from the Great Salt Lake.

4.3.4 Winds

No wind data are available for either the South Clive site or the transportation corridors. The maximum peak gust recorded at Dugway Proving Ground, 40 miles southeast of the South Clive site, during the period 1957 to 1965, was 71 miles per hour.

On the basis of weather records for Salt Lake City, the prevailing winds at the Vitro site should be generally from the southeast and south-southeast and have a mean speed of 8.7 miles per hour. The mean monthly wind speed varies from 9.5 miles per hour in April to 7.5 in December. The highest one-minute duration wind speeds have generally been from the west or northwest, the high being 71 miles per hour in March and the lowest high 52 miles per hour in January. Wind distributions assumed for the Vitro site are tabulated in Section G.2 of Appendix G.

4.3.5 Storms

Based on a 39-year data record for Wendover, the South Clive site has an annual average of 48 days with 0.01 inches or more of precipitation; they are evenly distributed throughout the year. Thunderstorms occurred on 29 days per year over a 5-year period, the monthly maximum being 8 days in June. Snowfalls of 1.0 inch or more occurred an average of 3 days per year over a 25-year period. An average of five days per year had heavy fog over a five-year period. Over 8 years, an average of 152 days per year were clear, 92 were partly cloudy, and 121 were cloudy.

During the period from 1928 to 1978, the Salt Lake City area had an annual average of 88 days with 0.01 inch or more of precipitation; 10 of those days occurred in each of the months of January, March, and April. On the average, only four days of measurable precipitation have occurred in July. Thunderstorms occurred on an average of 35 days per year, with a high of 7 days in July and none in November, December, or January. Snowfalls of 1 inch or more have occurred on an average of 18 days per year. Heavy fog has generally occurred 11 days per year but during the winter months only. On the average, 127 days per year have had clear skies, 104 have been partly cloudy, and 134 cloudy.

4.4 AIR QUALITY

The Vitro site is located in Salt Lake County and the South Clive site is located in Tooele County. The National Ambient Air Quality Standards (NAAQS) are used to classify the counties as being below the NAAQS (attainment) or above the NAAQS (nonattainment). Tooele County is classified as meeting all NAAQS. Salt Lake County is classified as nonattainment for TSP (total suspended particulates) and ozone. Only Salt Lake City is in nonattainment status for carbon monoxide. The Utah State implementation plan requires that appropriate measures be taken in Salt Lake City to reach the NAAQS by 1985. However, the TSP annual geometric mean concentration for Salt Lake City for 1981 was 67 micrograms per cubic meter, which is less than the NAAQS annual geometric mean of 75 micrograms per cubic meter. The ambient TSP concentrations at the Vitro site were measured in a year-long monitoring program that was initiated in January 1982. Measurements of TSP were made five times a month with high-volume air samplers at two locations on the Vitro site. The monthly means of data obtained through 1982 have ranged from 53 micrograms per cubic meter to 149 micrograms per cubic meter; the average annual mean for stations north and south of the site are 69 and 91 micrograms per cubic meter respectively.

Tooele County, which includes the South Clive site, is in attainment status for all NAAQS. TSP measurements at the South Clive site have yielded monthly means that range from 5 micrograms per cubic meter to 42 micrograms per cubic meter; the average annual mean is about 18 micrograms per cubic meter.

4.5 SURFACE AND SUBSURFACE FEATURES

The following subsections summarize geologic features that could affect the suitability of the South Clive site and the Vitro site for stabilization of residual radioactive wastes and other contaminated materials.

4.5.1 Physiography and topography

The South Clive site is located within a relatively flat area along the eastern edge of the Great Salt Lake Desert. The desert area extends for approximately 60 miles from the Nevada border on the west to a series of north-south-trending mountain ranges on the east. The eastern edge of the desert in the vicinity of the site is formed by the Cedar Mountains, which rise to elevations of approximately 7700 feet (approximately 3500 feet above the desert floor). The proximity of this mountain range results in a generally westward slope to the site, with drainage into the Great Salt Lake Basin. The site has a topographic relief of less than 11 feet.

The Salt Lake City area is located in a large basin drained by the Jordan River and located between the Wasatch Mountains to the east and the Oquirrh Mountains to the west. The original topography of the Vitro site has been modified; the undisturbed elevations range from 4235 to 4250 feet and the drainage is to the northwest, toward the Jordan River.

4.5.2 Geologic features

Because of the lack of detailed subsurface data concerning the bedrock, the exact depth to and relationships among various bedrock units at the South Clive site are unknown. Lone Mountain, located 3 miles east of the site, has a core of Paleozoic rocks. These include, from west to east, the Grandeur Member of the Park City Formation, an unnamed Permian formation, and Unit 5 of the Oquirrh Formation (Maurer, 1970). These well-indurated limestones and sandstones strike slightly east of north (approximately N12E) and dip steeply (72 to 74 degrees) to the west. Lone Mountain represents the west limb of a north-trending anticline, which is in turn located on the upper plate of the Lone Mountain Thrust Fault, a slightly northwest-trending Laramide (early Tertiary) low-angle fault.

The scattered, low hills about 1.5 miles west of the site (see Figure 3-6) also contain outcrops of Paleozoic Oquirrh Formation (Moore and Sorensen, 1979). These rocks may represent the northern extent of a slightly northeast-trending overturned anticline. The South Clive site may be located in the syncline between this anticline and the Lone Mountain anticline to the east.

The Grayback Hills 3.5 miles northwest of the South Clive site (just north of Interstate 80) are formed by remnants of Late Tertiary (Miocene-Pliocene) basalt and basaltic andesite flows (Moore and Sorensen, 1979). These flows are the only apparent evidence near the site of Late Tertiary tectonism.

Bedrock below the Vitro site is buried under a thick sequence of alluvial deposits. Arnow et al. (1970) indicate on a structure contour map that the unconsolidated Quaternary deposits below the site are at least 500 feet thick. However, the Tertiary "bedrock" underlying the Quaternary deposits also consists of semiconsolidated clay, sand and gravel, interspersed with lava and cemented layers of sand and gravel (Arnow et al., 1970). These

semiconsolidated Tertiary sediments extend to a depth of 2200 feet below the mill site (Mattick, 1970). Because of the thicknesses of the Cenozoic deposits, the types of pre-Tertiary rocks existing below the site are unknown but they have no bearing on the suitability of the site because of their depth.

Structure

The most obvious geologic structure associated with the Clive and Salt Lake City areas is normal faulting. During the Miocene, Pliocene, and Pleistocene Epochs (1 to 25 million years ago), normal faults west of the Wasatch Range uplifted and tilted large blocks of the earth's crust into north-south-trending "basin and range" structures. The "range" portion of these structures include the Cedar Mountains east of Clive and the Oquirrh Mountains west of Salt Lake City. The "basins" include the Great Salt Lake Desert and the Salt Lake Valley.

As further described in Section 4.5.4, the South Clive site lies in a region which contains active faulting. Studies described in Appendix H show that seismogenic sources include zones of faulting along the east flank of the Cedar Mountains, the east flank of the Newfoundland Mountains, the west flank of the Stansbury Mountains, and within Puddle Valley. The density of possible seismogenic sources is considerably less than along the Wasatch Front located about 65 miles east of the site.

The Vitro site is located in an area of potentially active faulting. The Wasatch Fault is a north-south-trending, 150-mile-long normal fault zone which separates the Wasatch Mountains to the east from the Great Basin to the west. Considerable geologic evidence indicates that the Wasatch Fault has been active during Recent time. Furthermore, Cook (1970) indicates that vertical displacements of as much as 20 feet have occurred in a single event on the Wasatch Fault within the past 300 years. The potential seismic hazard at the Vitro site is addressed in more detail in Section 4.5.4 and in Appendix H.

Soils

Surface and subsurface conditions at the South Clive site and vicinity were evaluated through the drilling, logging, and sampling of 13 exploration borings. The logs of the exploration borings are available in the UMTRA Project Office in Albuquerque, New Mexico.

Surficial soils encountered in the 13 exploration borings generally consisted of light brown to tan, sandy to clayey silt. These soils were classified as either stiff or very stiff and were noted to contain a small pinhole structure and bedding layers that ranged from approximately 0.06 to 1.0 inch in thickness. The thickness of surficial soil varied from 3.0 feet in Borings SC-4 and SC-5 (northern edge of site) to 11.0 to 12.0 feet in Borings SC-2 and SC-3 (southern edge of site).

Underlying the surficial material is an interlayered lacustrine deposit ranging from relatively clean fine- and medium-grained sands to silty

clays. This interlayered soil sequence appears to be random and no definite pattern or predominant material type could be correlated among individual borings. In general, the soils are layered but varied in thickness from about 0.1 inch in stringers to 4 feet. The cohesive materials encountered were generally classified as stiff to very stiff while the cohesionless materials were generally medium dense to dense. This interlayered sequence extends to depths between 45 and 51 feet below the existing grade.

Beneath the interlayered sequence the predominant material becomes a grayish-brown to brown silty sand with a consistency classification ranging from medium dense to very dense. In Boring SC-1, drilled to a depth of 250.8 feet, the material was continuous below a depth of 51 feet with minor variations in silt or clay content and occasional zones where thin stringers of finer-grained materials were encountered. At a depth of 75 feet, zones were noted that contained coarse sand and gravel. At a depth of approximately 128 feet, the material was classified as very dense and remained consistent to the depth penetrated.

Soils data for the Vitro site are available in the UMTRA Project Office in Albuquerque, New Mexico, and were included in Appendix A of the DEIS.

4.5.3 Mineral resources

Small amounts of sand, gravel, and ground water have been produced from the alluvium surrounding the Cedar Mountains east of the South Clive site. One source of gravel near the South Clive site was documented to be in Section 18, T1N, R9W (Maurer, 1970, p. 173). Sources nearer the site may be located on the west flank of Lone Mountain in Section 34, T1S, R11W and Section 3, T2S, R11W. However, no aggregate has been produced in the Lone Mountain area or within the South Clive site. Because of the large quantity and widespread distribution of sand and gravel, the very small population and the resulting small demand, and the long distance to any large market, the potential for sand and gravel production in the vicinity of the South Clive site is very small.

The Vitro site is located in a valley that contains thick clay, silt, and sand deposits. The deposits immediately underlying the site have no known characteristics that differ from those underlying surrounding areas. These deposits therefore, have no known economic value and no potential for near-term development.

4.5.4 Seismic Hazard

The following paragraphs briefly review the seismic history of the region, the Maximum Credible Earthquake, and its recurrence interval. A more detailed evaluation of the potential earthquake effects on the Vitro and South Clive sites is attached as Appendix H.

Seismotectonic Setting-South Clive

The South Clive site is located within the Great Basin in the Basin-and-Range Province (BAR) in western Utah. The site is in a transition zone between exposed BAR horsts and grabens (mountain ranges and valleys) to the east and buried BAR horsts and grabens to the west. The site area does not have recorded historical seismicity but nearby seismogenic areas and geologic structures could pose a hazard to the site.

Seismogenic sources (active faults) which could pose a hazard to the site include fault zones along the east flank of the Cedar Mountains, the east flank of the Newfoundland Mountains, the west flank of the Stansbury Mountains, and within Puddle Valley. Other fault zones in the site region do not show evidence of being active.

The historical earthquake data base is from 1850 through 1978 and magnitude 5.5 and larger earthquakes are shown in Table 4-1. The 1934 Hansel Valley event is the only moderate to large historical earthquake to pose significant hazard to the site, but this hazard is less than that associated with nearer seismogenic structures.

Maximum Credible Earthquakes and Recurrence Interval - South Clive

To assess the hazard to the site and to determine site design criteria, it is necessary to establish a Maximum Credible Earthquake (MCE) for each seismogenic fault which could affect the site. The MCEs calculated for the seismogenic sources affecting the South Clive site range in value from M_s of 6.8 to 7.3. These result in mean maximum expected accelerations in bedrock at the site of from 0.19 g to 0.31 g with expected variations of ± 0.06 g. The MCE's were calculated using total length fault rupture, and recurrence intervals similar to other Basin and Range tectonic settings, in excess of 10,000 years for each individual fault.

Seismotectonic Setting--Vitro

The Vitro site is located along the Wasatch Front which delineates the boundaries between the Great Basin to the west and the Colorado Plateau in southeastern Utah and the Middle Rocky Mountains in northeastern Utah. The Wasatch Front is part of a distinct north-trending zone of elevated seismic activity which extends from northern Arizona to northwestern Montana. This zone, known as the Intermountain Seismic Belt, has experienced at least 15 recorded earthquakes with Richter magnitudes greater than 5.5 in 129 years of record. The largest of these 15 earthquakes was a magnitude 7.1 event which occurred in 1959 at Hebgen Lake, Montana.

Historical earthquake documentation has been completed from the period of 1850 until 1980. Table 4-1 is a listing of the largest earthquakes from 1850 through 1978 in the Utah region. Two of these earthquakes (1910 and 1914) may be directly related to the Wasatch Fault. The most damaging earthquakes of the north central region of Utah occurred in Hansel Valley in 1934 and in Cache Valley in 1962.

Based on earthquake history and geologic evidence, the Salt Lake City region contains numerous young faults, including the Hansel Valley, East Cache, Wasatch, and unnamed faults along the west flank of the Oquirrh Mountains south of the Great Salt Lake.

Table 4-1. Largest Earthquakes in the Utah Region 1850 Through 1978^a

Local Date	Lat (°N)	Long (°W)	Intensity I _O	Magnitude M _L	Location
1884 Nov 10	42.0	111.3	VIII	(6)	Bear Lake Valley
1887 Dec 5	37.1	112.5	VII	(5-1/2)	Kanab
1900 Aug 1	40.0	112.1	VII	(5-1/2)	Eureka
1901 Nov 13	38.8	112.1	IX	(6-1/2+)	Richfield
1902 Nov 17	37.4	113.5	VIII	(6)	Pine Valley
1909 Oct 5	41.8	112.7	VIII	(6)	Hansel Valley
1910 May 22	40.8	111.9	VII	(5-1/2)	Salt Lake City
1914 May 13	41.2	112.0	VII	(5-1/2)	Ogden
1921 Sep 29	38.7	112.2	VIII	(6)	Elsinore
1921 Oct 1	38.7	112.2	VIII	(6)	Elsinore
1934 Mar 12	41.7	112.8	IX	6.6	Hansel Valley (Kosmo)
1959 Jul 21	37.0	112.5	VI	5.5+	Utah-Arizona border (Kanab)
1962 Aug 30	42.0	111.7	VII	5.7	Cache Valley (Logan)
1966 Aug 16	37.5	114.2	VI	5.6	Nevada-Utah border
1975 Mar 28	42.1	112.5	VIII	6.0	Idaho-Utah border (Pocahontas Valley)

^aTable includes earthquakes of maximum Modified Mercalli intensity (I_O) of VII or greater, or of Richter magnitude 5.5 or greater. Magnitudes in parentheses are estimated from I_O. Sample area: 36°45'N - 42°30'N, 108°45'W - 114°15'W. Aftershocks are excluded.

Source: Arabasz et al., (1979).

Due to the close proximity of the Wasatch Fault to the Vitro site (Figure 4-1) and its suspected activity, the earthquake risk from this fault system is greater than the risk from earthquakes generated by rupture of the other fault systems mentioned above.

In terms of current criteria, an active fault is defined as a structure which has experienced displacement in the last 10 to 12 thousand years. The northern portion of the Wasatch Fault has been thoroughly identified as falling within the active fault category. There have been no surface faulting events along the Wasatch Fault during the past 130 years (approximate). Geologic evidence, however, identifies multiple displacement episodes in the northern portion of the fault system. The segment of the Wasatch Fault zone closest to the Vitro site is the East Bench Fault about 3 mi east of the site (Figure 4-2). No detailed displacement history is available for this fault segment; however, its geomorphic expression definitely indicates movement during the Quaternary Period.

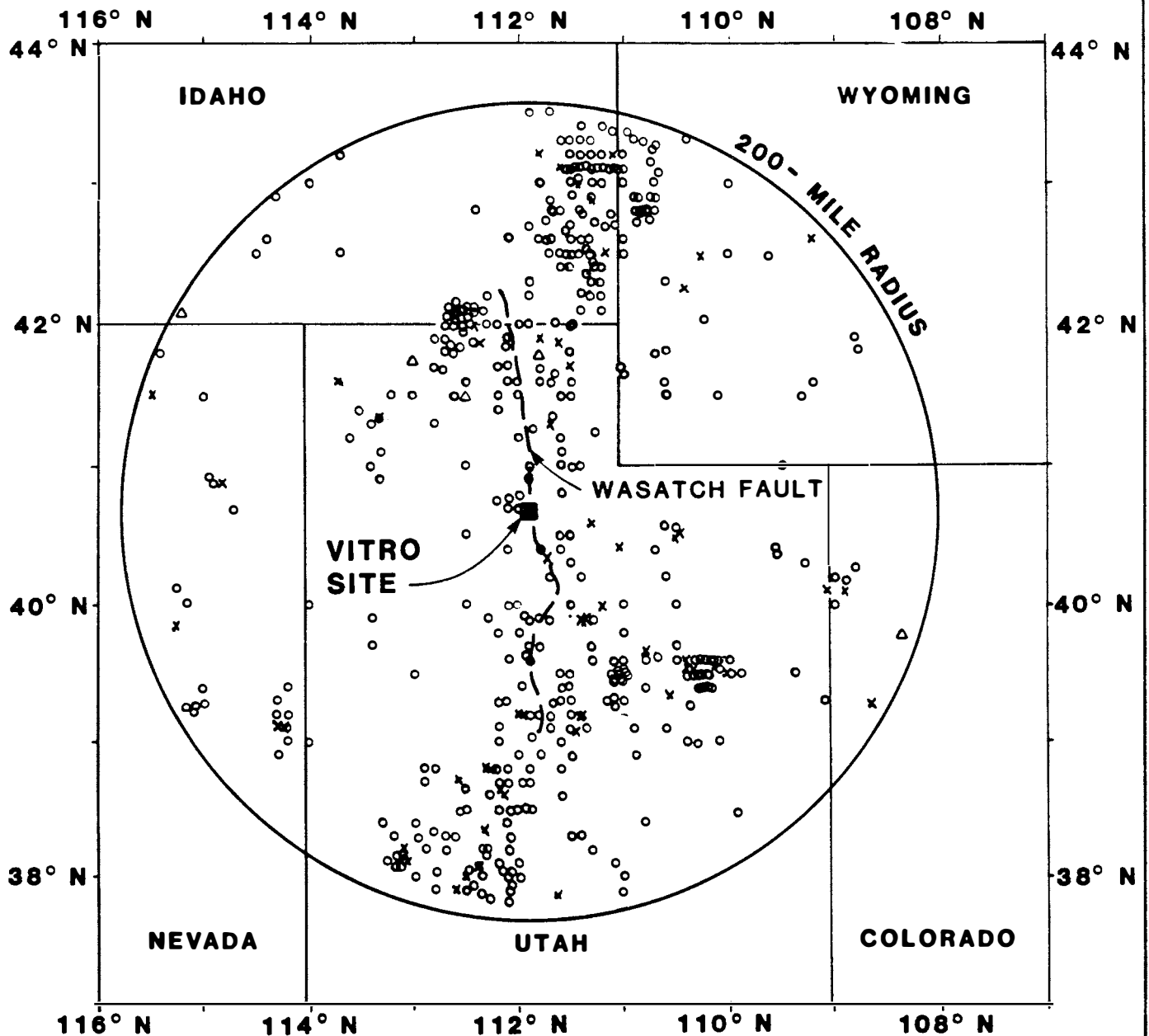
Maximum Credible Earthquake and recurrence interval-Vitro

To assess the hazard to the embankment at Vitro due to seismic events, it is necessary to establish the Maximum Credible Earthquake (MCE). The design hazard is based on the Maximum Credible Earthquake. Studies by others to quantify the MCE and its recurrence interval for the Wasatch Front are still ongoing; however, sufficient analyses have been completed to establish reasonable design criteria.

Based upon the current knowledge of recurrence intervals of earthquakes along the Wasatch Front, it is likely that a Richter magnitude 7.0 or greater earthquake somewhere along the front will cause ground shaking at the Vitro site within the next 200 years. The East Bench Fault segment is the closest fault to the site and would cause the most intense ground shaking if rupture were to occur at that location. The return period of a large event (6.5 to 7.5 magnitude) is estimated to be about 50 to 660 years for the entire Wasatch Front, but the return period for a similar large event along the East Bench Fault would be several times longer. It is not possible to assign a specific MCE and recurrence interval for this fault, but based on results from various investigators, the MCE would probably be about magnitude 7.5 and the recurrence interval between 1000 and 2000 years. The MCE for the Vitro site would be in the range of magnitude 6.0 to 7.5. If this event occurred on a nearby fault such as the East Bench, on-site ground accelerations in rock would be about 0.3 to 0.55 g.

Analysis of selected failure surfaces of the slopes of the embankment indicates the minimum ground acceleration that could cause possible minor damage is about 0.23 g. This ground acceleration could be associated with an earthquake event of lesser magnitude than the MCE.

Due to the proximity of the active faults, the interbedded nature of the foundation soils, and the effects of damping/amplification on a specific earthquake event, a return period of the predicted yield acceleration of 0.23 g cannot be ascertained with any confidence level.

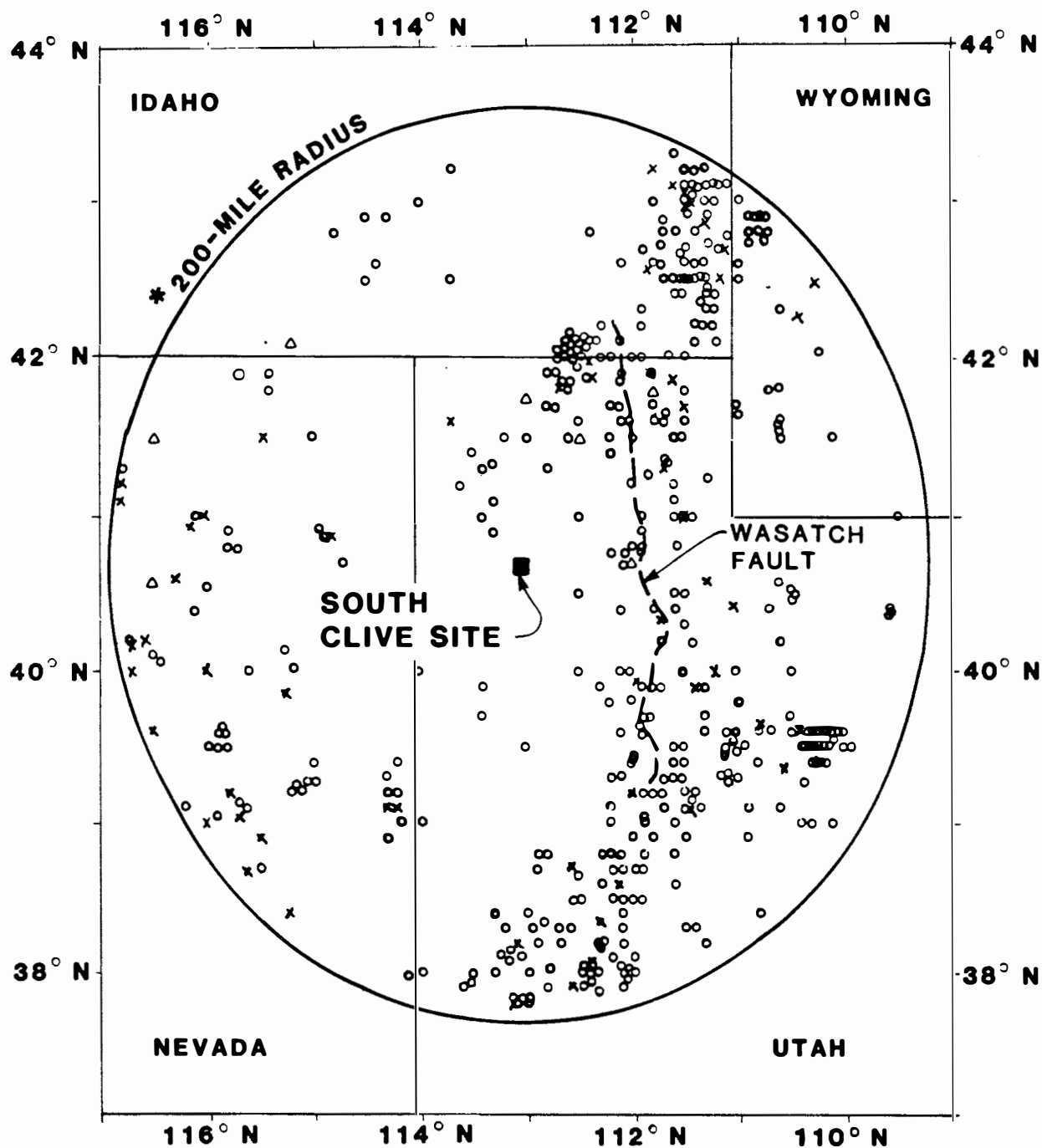


REFERENCE: NOAA, 1982
873 EARTHQUAKES PLOTTED 4/13/82

MAGNITUDE

- 0.00 M 3.99
- x 3.99 M 4.99
- △ 4.99 M 7.00

FIGURE 4-1
EARTHQUAKE EPICENTERS WITHIN A 200 - MILE RADIUS
OF THE VITRO SITE



REFERENCE: NOAA. 1982
881 EARTHQUAKES PLOTTED 8/23/82

*Vertical scale exaggerated on
NOAA's computer plot.

MAGNITUDE

- 0.00 M 3.99
- × 3.99 M 4.99
- △ 4.99 M 7.00

FIGURE 4-2
EARTHQUAKE EPICENTERS WITHIN A 200-MILE RADIUS
OF THE SOUTH CLIVE SITE

4.6 WATER

The following subsections describe existing surface-water and ground-water systems potentially affected by alternative remedial actions, their quality and current utilization.

4.6.1 Surface water

The Vitro site, the South Clive site, and the transportation routes all lie within the Great Basin drainage, a closed basin having no outlet. Much of the basin drains to the Great Salt Lake, which covers an area of about 1700 square miles and contains about 16 million acre-feet of water (Keck and Hassibe, 1979). Because of its high salt content (around 25 percent), most forms of aquatic life cannot survive in the lake. The largest species is the brine shrimp, which is less than half an inch long.

The Vitro site and about 57 miles of the transportation corridors ultimately drain to the Great Salt Lake (Figure 4-3). About 5 miles of the corridors drain to the Puddle Valley depression, which is normally dry. The South Clive site and the remaining 8 miles of the transportation routes drain into the normally dry Ripple Valley depression on the eastern fringe of the Great Salt Lake Desert.

The arid to semi-arid climate that prevails profoundly affects the surface-water regime. With the exception of Timpie Springs, effectively all perennial watercourses are in Salt Lake County and most of them are man-made. Within 1 mile of the transportation corridors, there are 73 watercourses and more than 50 ponds or lakes shown on U.S. Geological Survey quadrangle maps. Of the 73 watercourses, 3 are natural perennial drainages, 3 are aqueducts, and 10 are perennial man-made canals. The remaining 57 are shown as intermittent or ephemeral streams; most are probably ephemeral, that is, they flow only in direct response to precipitation. Of the 50-plus ponds, 16 are shown as perennial, 4 are salt evaporators, and the rest are intermittent or ephemeral. Some of the intermittent ponds in the vicinity of the Great Salt Lake are merely depressions with elevations such that fluctuations in the ground-water table probably determine whether water is present on the surface. Three of the perennial ponds are associated with industrial use. All of the perennial water bodies are within the Great Salt Lake drainage basin; none is closer than 28 miles to the South Clive site.

No surface-water bodies are present on the South Clive site. The nearest stream channel ends about 2 miles east of the site and is typical of all the drainages along the transportation corridors within about 20 miles of the South Clive site. Streamflows from higher elevations usually evaporate and infiltrate into the ground before reaching lower, flatter land. The stream channels are well defined in their upper reaches, but as they approach the flatlands the size of the channel reduces until there is no evidence of a stream. In extreme events, such as a Probable Maximum Flood (PMF), sheet flow could pass over the South Clive site but it would be nonchannelized.

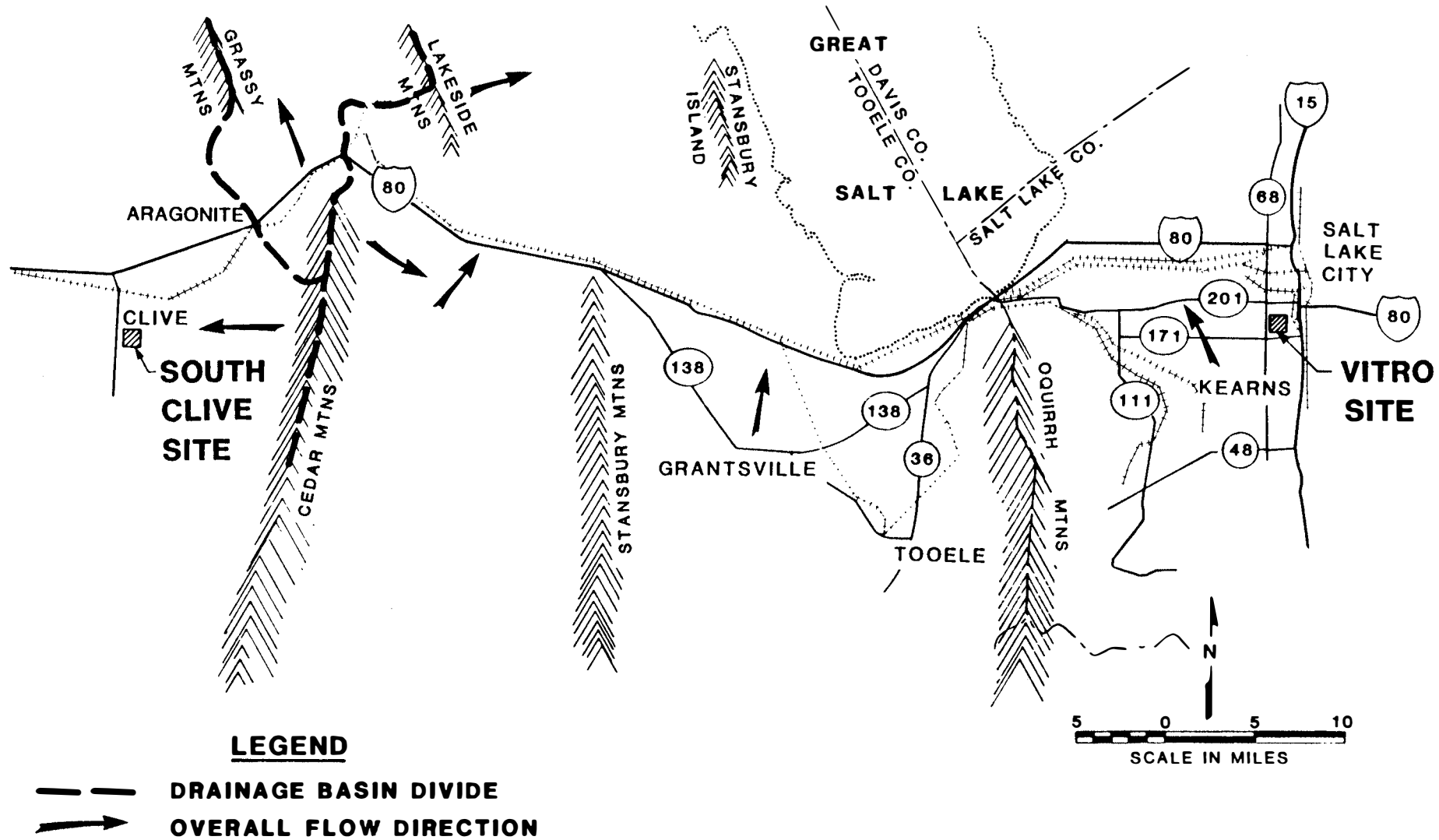


FIGURE 4-3
SURFACE DRAINAGE PATTERNS

Four surface water bodies are in close proximity to the Vitro site. The Jordan River flows north to the Great Salt Lake and is about 1500 feet west of the site. Jordan River flows are regulated, being the outlet for Utah Lake, and average about 380 cubic feet per second (USGS, 1980). Mill Creek, a perennial stream, flows along the north edge of the site. This creek empties directly into the Jordan River and has a mean average flow of about 10 cubic feet per second (FBDU, 1981). Two flowing drainages are on the Vitro site (see Figure 3-2). The Vitro Waste Ditch flows from east to west, bisecting the approximate western half of the site and empties into the Jordan River. The South Vitro Ditch flows from south to north and joins the Vitro Waste Ditch near the center of the site. The South Vitro Ditch and the Vitro Waste Ditch have average flows of about 3 and 24 cubic feet per second, respectively (FBDU, 1981). The site does not contribute runoff to the South Vitro ditch except in severe rains; the ditch is primarily fed by ground water.

None of the surface water bodies in the vicinity of the Vitro site, the transportation corridors, or the South Clive site are used for drinking purposes and most have no beneficial use. The first body of water east of the South Clive site that is utilized is 28.1 miles distant. At this point, a perennial stream flows from Big Spring (1000 feet south of I-80) to the Timpie Springs Waterfowl Management Area, about 2000 feet north of I-80. No other perennial stream crosses the transportation routes within Tooele County. In Salt Lake County, 11 perennial, man-made watercourses cross the transportation corridors between Lake Point Junction (mile 53) and I-15 (mile 70.5). The 11 watercourses are used for industrial flood control and irrigation purposes. The largest of these streams is the Surplus Canal, which was constructed in the late 1800s to divert Jordan River floodwaters away from central Salt Lake City. The Surplus Canal diversion is about 1 mile downstream of the Vitro site. It has been effective, and neither it nor the Jordan River are expected to overtop their banks near the transportation corridors or the Vitro site in floods with a recurrence interval of 500 years or less, according to preliminary studies conducted for the Federal Emergency Management Agency.

There are ten perennial water bodies within 500 feet of the railroad or highway along the transportation corridors but the only major body is the Great Salt Lake. Of the remaining nine, four are salt evaporators for industrial use and controlled by the operating salt companies. Two other ponds are subjected to direct runoff from industrial operations (e.g., a slag dump at mile 54). A group of ponds east of Timpie, at miles 30 through 33, are located in an area of low ground with a high water table that results in large areas of very shallow (less than 1 foot deep) standing water with no definable outlet. Another pond, at mile 59.3, is also the result of ground water and covers less than 1 acre with no visible inlet or outlet. The last perennial pond within 500 feet of the transportation corridors lies between two sets of railroad tracks from miles 58.5 to 60.6 and has no apparent use.

Description of watersheds

The South Clive site lies to the west of the Cedar Mountains in a relatively flat basin. The streams within the watershed do not normally reach the site; the channels end 2 miles east of the site. This indicates that

flows normally infiltrate or evaporate before reaching the South Clive site. There is no outlet for the watershed and any water that flows by the site would pond in a playa several miles to the west. The watershed above the site covers approximately 46 square miles (Figure 4-4).

The Vitro site lies within the drainage system of Salt Lake City and County. The flow regimes of the two major streams in close proximity to the site, the Jordan River and Mill Creek, are regulated by the various interconnecting canals which have been constructed throughout the area and are not subject to natural variations. These canals are designed for short-term floods (typically 50- to 100-yr flood events), but for long time periods or a Probable Maximum Flood their controls would fail and, thus, their effects can be ignored. The effective drainage area of the Jordan River is about 3100 square miles, while that of Mill Creek is about 32 square miles. The Jordan River Basin starts at the headwaters of the Provo River and includes Deer Creek Reservoir and Utah Lake. The flow of the Jordan River is controlled by gates and pumps on Utah Lake, which is a natural lake that has been artificially modified to control its water level.

Historical floods

No data on historical floods are available for either the South Clive site or the Tooele County portion of the transportation corridors. Flow records, from December 1942 to the present, are available for the Jordan River/Surplus Canal. The Surplus Canal diversion is about 1 mile downstream of the Vitro site. Almost all of the flood flow is diverted through the Surplus Canal; since 1952, the maximum flow in the Jordan River just downstream of its confluence with the Surplus Canal has been limited to 200 cubic feet per second. The maximum combined flow was about 2300 cubic feet per second in September of 1978 (USGS, 1980). No records are available for Mill Creek, which is on the north edge of the Vitro site.

Some flow data (USGS, 1980) are available for the drainages along the transportation corridors within Salt Lake County, but the periods of record are generally short. The maximum recorded flows in the vicinity of I-80 are 790 and 1390 cubic feet per second for the Jordan River and Surplus Canal, respectively. Peak flows at gaging stations near I-80 and the Great Salt Lake have been less than 400 cubic feet per second. These gaging stations are along the transportation corridor at miles 66.2, 59.8, and 56.5, respectively (Figure 4-3).

Synthetic flood analyses

The Probable Maximum Flood (PMF) for the South Clive site resulting from a 6-hr Probable Maximum Precipitation (PMP) of 9.7 inches over the 46-square-mile drainage area was calculated using dam design techniques (US DOI, 1977). The results of the analysis indicate that the PMF would have a peak flow of 45,000 cfs.

Estimates of peak flood flows near the Vitro site were developed using two different sources. The HEC-1 program was used to develop PMF hydrographs.

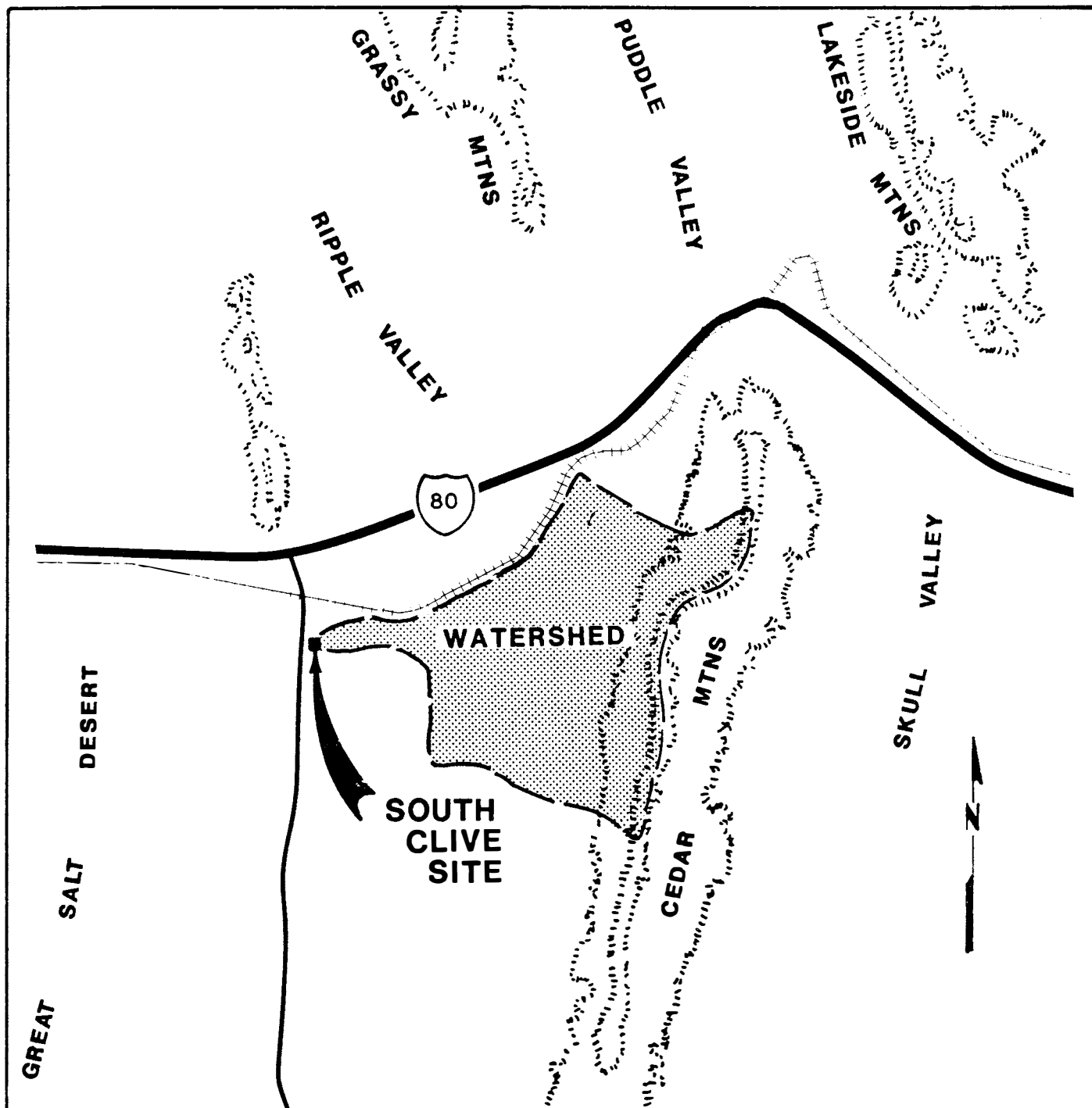


FIGURE 4-4
SOUTH CLIVE WATERSHED

Flood flows for 100- and 500-year return periods were obtained from the Federal Emergency Management Agency (FEMA, 1980). The FEMA studies presented flood values for the Jordan River above the Surplus Canal as 2000 and 2700 cubic feet per second for the 100- and 500-year return periods, respectively. Preliminary indications are that these floods would not overtop the banks of the river at the Vitro site. The FEMA studies presented a 100-year flood of 600 cubic feet per second for Mill Creek at the Vitro site, which should also stay within the channel. The FEMA studies also indicate that the Jordan River would stay within its banks near I-80 under the 100- and 500-year flood conditions.

The PMF for the Jordan River was developed at its confluence with Mill Creek, just downstream of the Vitro site. Two kinds of PMF were calculated: one for a general, 72-hour storm over the entire drainage, and the other for a local, 6-hour storm over a 500-square-mile area at the downstream end of the basin with a 24-hour general storm occurring simultaneously on the remainder of the basin. The general 72-hour PMF would be the more severe of the two, resulting in a peak flow of 414,000 cubic feet per second. The corresponding flood elevations were calculated using the HEC-2 program (Hydrologic Engineering Center, 1979) along with the slope-area method for uniform flow computations. The water-surface elevation resulting from a peak flow of 414,000 cubic feet per second near the Vitro site was calculated as about 4276 feet. This elevation is about 11 feet above the existing ground near the Vitro site and would create flow velocities of approximately 3 to 4 feet per second.

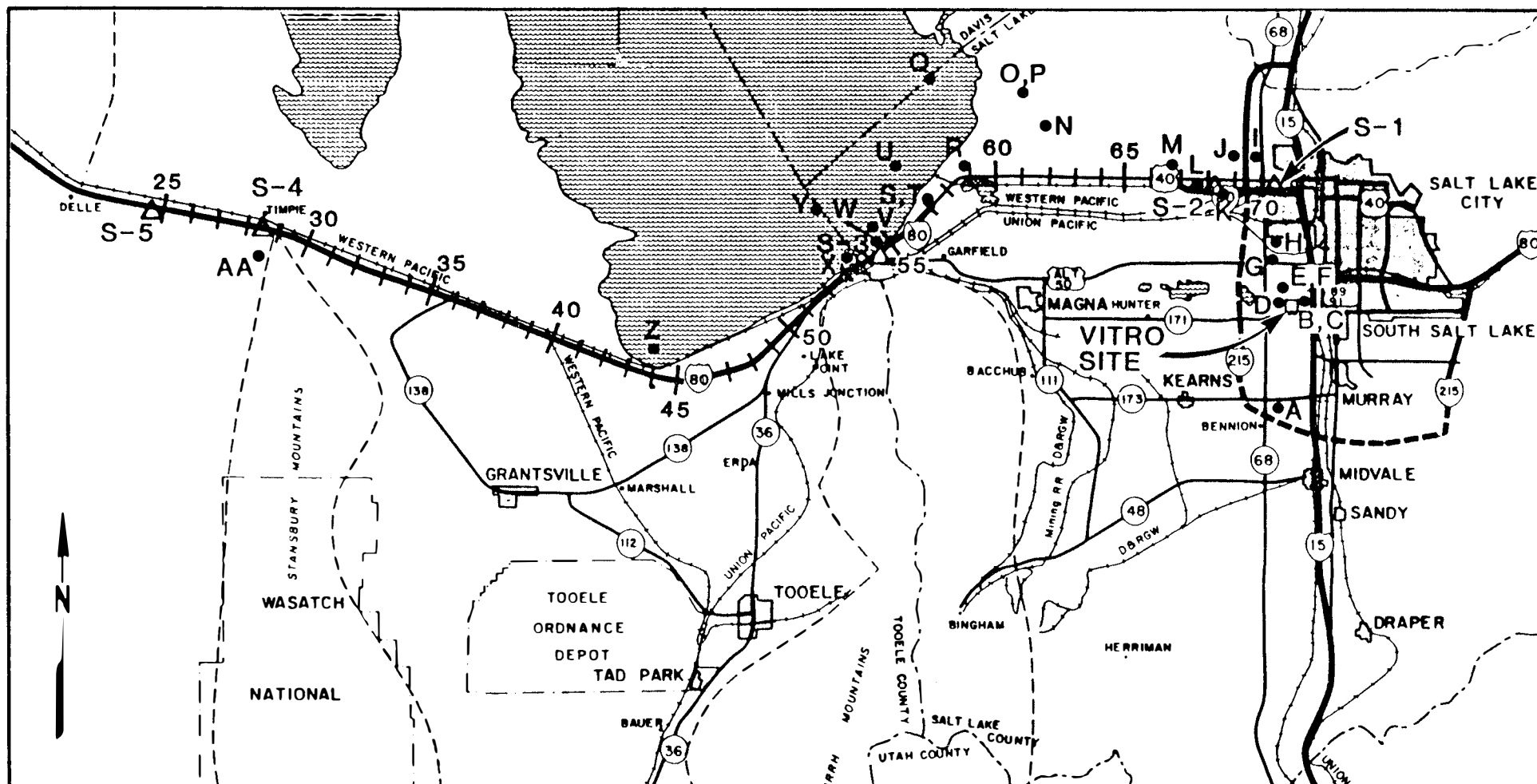
The PMF for Mill Creek was also developed for the Vitro area. The HEC-2 (Hydrologic Engineering Center, 1979) analysis showed that the natural topography of the Jordan River Valley limits the water-surface elevation and peak flow velocity to about 4237 feet and 2.1 feet per second, respectively, at the Vitro site.

Water quality and utilization

The project region can be divided into two areas regarding water quality and use: Salt Lake County and Tooele County. Generally speaking, water-quality data are available for Salt Lake County but not for Tooele County.

Figure 4-5 shows locations of sampling points for the water quality monitoring program. State of Utah and the U.S. Geological Survey sampling stations are also indicated.

Water-quality data are generally unavailable for Tooele County, which is a reflection of the lack of water and population centers. The only water quality station is at the source of Big Spring near Timpie (S.4 at mile 28.5 on Figure 4-5). The spring feeds a waterfowl management area and has no other uses. The water is very hard and very high in dissolved solids, primarily sodium and chloride (salt). Moderate concentrations of arsenic, nickel, copper, and silver are also present.



LEGEND

30 35

Mileage on I-80 from South Clive Overpass

• N

Water quality stations from State of Utah and U.S. Geological Survey

△ S-3

Project monitoring stations

BASE MAP REFERENCE:
UTAH TRAVEL COUNCIL, NO DATE.

SCALE:
1 INCH EQUALS
APPROXIMATELY 6.2 MILES

FIGURE 4-5
LOCATIONS OF WATER QUALITY SAMPLING STATIONS

Numerous watercourses are monitored in Salt Lake County, but this discussion deals only with the water quality of streams in the immediate vicinity of the transportation corridors and the Vitro site, which are effectively at the downstream end of Salt Lake County. By the time water nears the affected areas, much of it is return flow from irrigation and industrial purposes, and is being routed to the Great Salt Lake as a means of disposal.

The water quality of the streams in Salt Lake County is reasonably well known, and is discussed by Hely et al. (1971). The water is very hard, and softening is desirable for most purposes. Water from the Jordan River is unsuitable for municipal or domestic use without treatment. This also applies to connected canals such as the Surplus Canal, North Point Consolidated Canal, and Goggin Drain. The Jordan River is organically polluted, has a high dissolved-solids content (>1000 mg/l), and contains very fine sediment which is difficult to remove. The water would probably be suitable for industrial cooling and ore processing uses. Water from the Jordan River is generally acceptable for irrigation but is marginal for stock watering because of the organic pollution.

The water quality of the Garfield and Kennecott Drains, and Lee Creek (miles 52.7, 66.2, and 59.8, respectively, as numbered on Figure 4-5) is much poorer than that of the Jordan River. It is unlikely that these waters would be suitable for industrial or irrigation uses.

Great Salt Lake water is used for two industrial purposes: mineral extraction and brine shrimp production. The lake is also used for recreation such as sailing, swimming, and game-bird hunting. The salinity of the water, up to eight times that of sea water, precludes most other uses.

Surface-water quality samples were taken from five locations along the transportation corridors (see Figure 4-5) to develop background data on the qualities of waters between the South Clive site and the Vitro site. Sample analyses indicate that both primary and secondary drinking water standards are exceeded: lead exceeded standards at all locations; chloride at locations 2, 3, 4, and 5; cadmium at locations 3 and 5; and chromium, silver, iron, and manganese at location 3. Results from analyses for major cations and anions, general parameters, metals, total metals, and radiochemistry are included in Appendix D.

The waters of Vitro and South Vitro ditches were analyzed for several metals (As, Ba, Cd, Cr, Mo, Pb, U) and pH. These results are reported in Table D-24, Appendix D.

4.6.2 Ground water

Existing ground-water conditions at the Vitro site are described in the following sections. The data and detailed analyses supporting this description are presented in Appendix D.

Vitro site. The Vitro site is located within the Jordan River Valley in South Salt Lake, Utah. The ground-water regime of this valley is generally characterized by two aquifer systems, a near-surface unconfined system and a deeper confined system. The unconfined system is principally recharged by upward flow from the confined aquifer and surface infiltration (Figure 4-6). The confined system is recharged by infiltration into porous materials on the flanks of the Wasatch Mountains to the east and the Oquirrh Mountains to the west. Near the site, both aquifers flow toward the west-northwest (Figures 4-6 and 4-7). The unconfined aquifer discharges into surface-water courses such as Mill Creek and the Jordan River.

The general stratigraphy of the Jordan River Valley in the vicinity of the site consists of several hundred feet of unconsolidated to poorly consolidated alluvial and lacustrine deposits of interbedded and highly lenticular sands, silty sands, silts, and clays. The fine-grained deposits were laid down in the lake environment of the prehistoric Lake Bonneville. The coarser-grained soils were deposited as alluvium, probably along the margins of this prehistoric lake as the levels fluctuated and lowered to its present condition, the Great Salt Lake.

The field investigations in the vicinity of the Vitro site indicate that approximately the upper 85 feet of subsoil consist of interbedded fine sand, silty sand, clay, and silt. These beds are often laterally discontinuous and vary in thickness from a few inches to several feet. Generally, the upper 50 to 70 feet of this complex profile form the unconfined aquifer system. The unconfined aquifer generally overlies strata of interbedded layers of low-permeability clays and silts. Because the materials of the unconfined aquifer are very similar to the underlying aquitard, the thickness of the unconfined aquifer varies and can only be estimated. Potentiometers installed between 10 and 60 feet below the ground surface revealed water levels at slightly below or slightly above the ground surface. Potentiometers installed below 70 feet revealed water levels 7.5 to 15 feet above the ground surface. Thus, in the vicinity of the tailings pile, the unconfined aquifer appears to be about 60 feet thick. The interbedded strata of this aquifer system produce water at variable rates. Results of a pump test and pumping for water-sample collection indicate that water yield can be much less than 1 gpm for the silts and clays and greater than 1 gpm, probably approaching 10 gpm, for the fine sands and silty sands. Detailed well logs of the recent investigation by the Technical Assistance Contractor (TAC) (1983) for the shallow wells are available for inspection at the DOE Uranium Mill Tailings Remedial Action Project office in Albuquerque, New Mexico.

The stratigraphy below a depth of about 85 feet also consists of interbedded silts, clays, and sands. The sand layers are generally coarser-grained than the overlying beds described above. In some instances the sand layers contain considerable gravel.

Recent work by Dames and Moore (1982) and the TAC (1983) included monitoring and pump wells to a maximum depth of about 130 feet below the ground surface. The wells that penetrated to a depth of about 70 feet or greater, below the ground surface, encountered ground water under artesian pressure. The hydraulic head levels ranged from about 7.5 feet above land

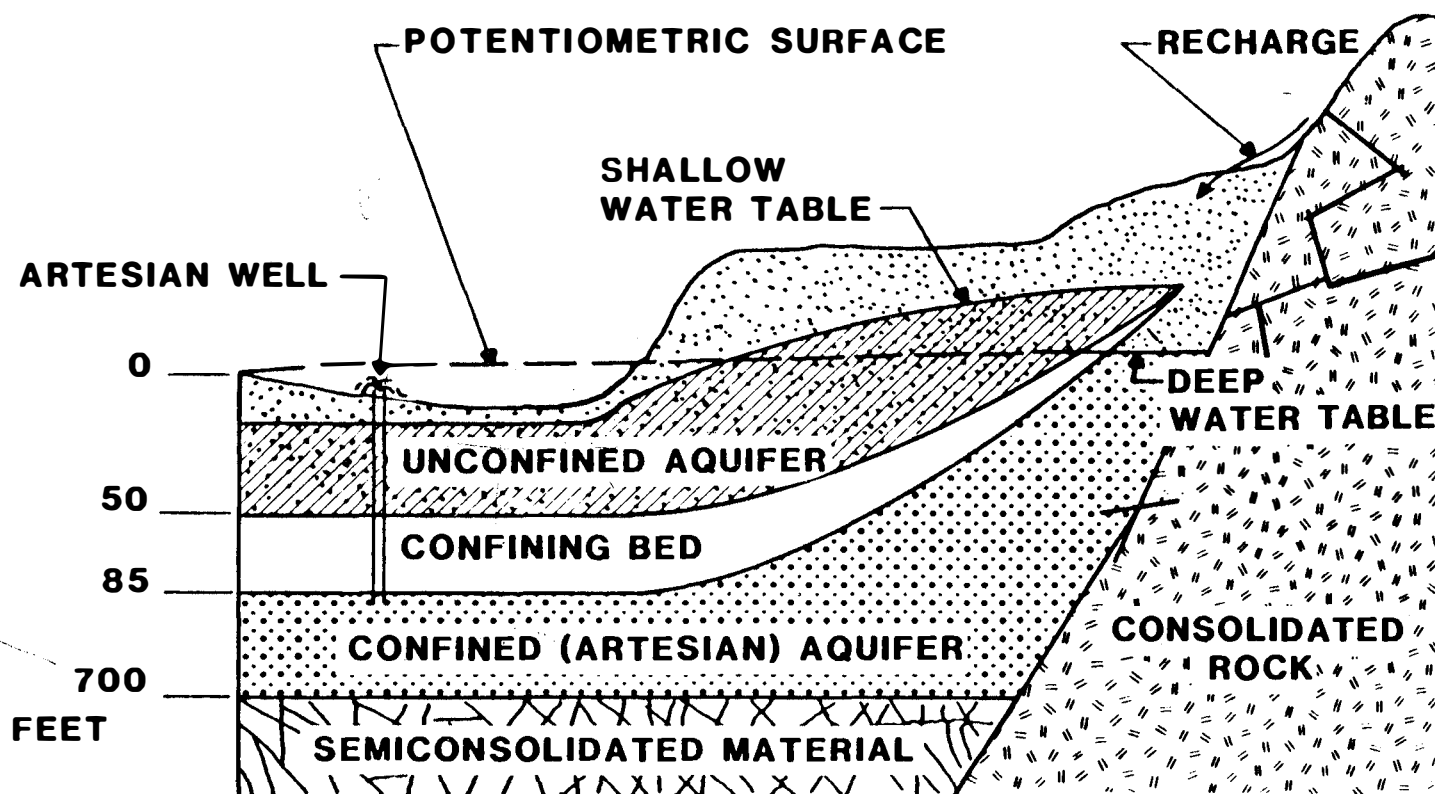
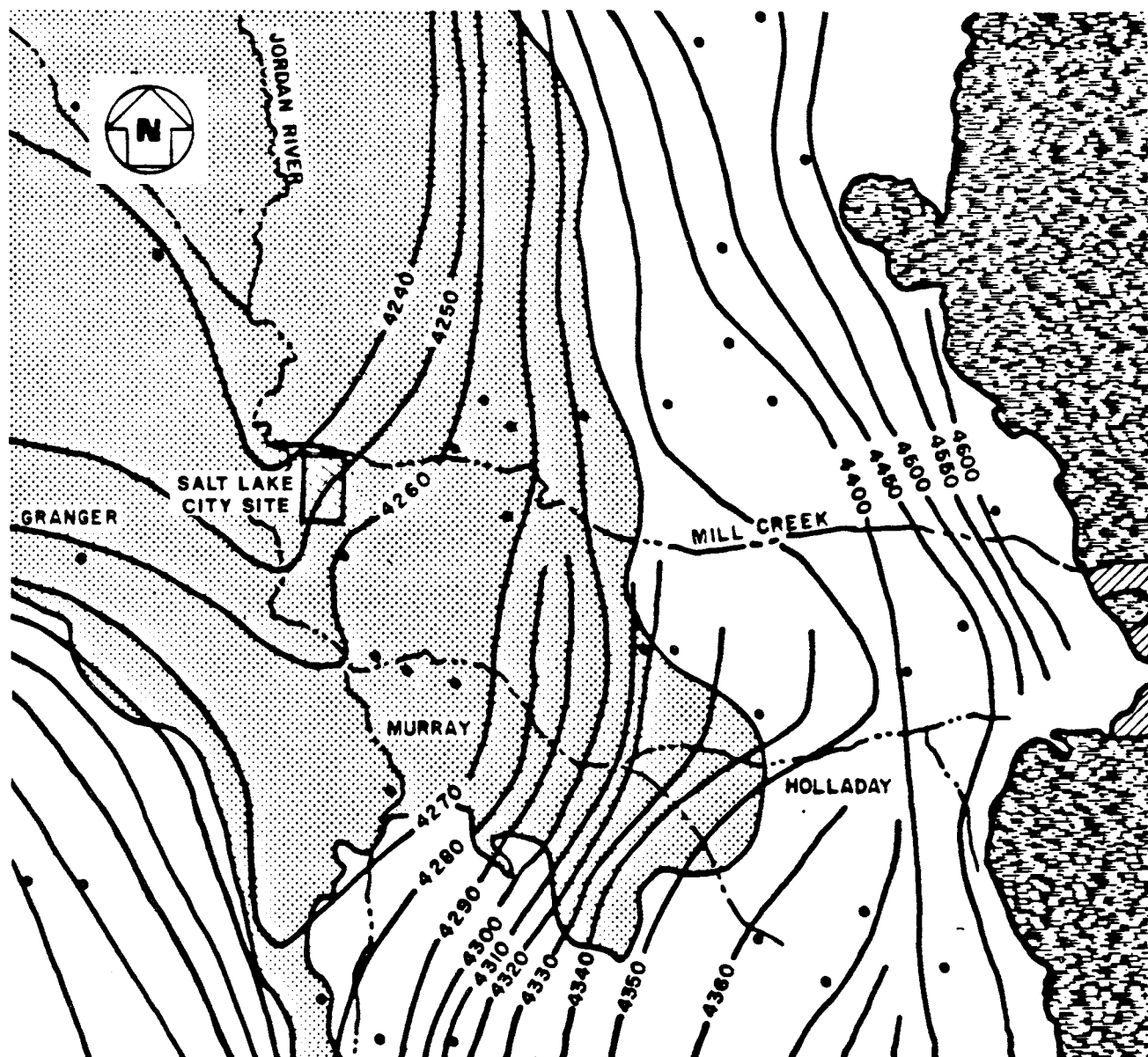


FIGURE 4-6
GENERALIZED GROUNDWATER HYDROGEOLOGY
FOR THE SOUTHERN SALT LAKE CITY AREA



 VALLEY FILL
PERMEABILITY VARIABLE

 ROCKS OF MODERATELY
LOW AND LOWEST
PERMEABILITY

 ROCKS OF MODERATELY
HIGH AND HIGHEST
PERMEABILITY

 AREA OF ARTESIAN FLOW -
FEBRUARY, 1969

 4250 WATER-LEVEL CONTOUR

NOTE

ADAPTED FROM HELY, MOWER,
AND HARR, 1971.

FIGURE 4-7
POTENTIOMETRIC SURFACE MAP OF THE CONFINED (ARTESIAN)
AQUIFER FOR THE SOUTHERN SALT LAKE AREA

surface for the well at 70 feet to a maximum of 15 feet above land surface for the wells at depths of about 130 feet. It is reported that this artesian aquifer system extends to depths of 500 to 800 feet below the ground surface (Hely et al., 1971).

Flow rates from 2-inch open potentiometers in the artesian aquifer ranged from a few gpm to several tens of gpm (TAC, 1983). Pump testing of an 8-inch well produced a sustained yield of about 300 gpm. Even though the producing sand layers of the confined aquifer are separated by clay and silt layers, monitoring of potentiometers at various depths in the aquifer during a long-term pump test indicates the sand layers are hydraulically connected. Detailed well logs of the recent investigation by the TAC (1983) for the deeper wells are also available for inspection at the DOE UMTRA office in Albuquerque, New Mexico.

Based on the well logs, a simplified subsurface cross-section, Figure 4-6, was constructed to illustrate the conditions described above. Again it should be noted that the subsurface strata consist of numerous laterally discontinuous layers of silt, clay, and sand of variable thickness.

The relationship of the two aquifers with regard to recharge, discharge, and movement of ground water, as determined by a recent pump test by the TAC (1983) and a previous study by Hely et al., (1971) are described in detail in Appendix D of this document.

The background water quality or chemistry of the two aquifer systems is substantially different. The upper unconfined aquifer water is characterized by a brackish quality with high total dissolved solids, generally 2000 ppm or greater. The unconfined water quality generally improves with depth and approaches the quality of the confined ground water. This water has limited use for domestic or agricultural purposes due to marginal quality and low yields. The confined aquifer water generally has dissolved solids values of about 300 ppm. The confined aquifer is a principal supply of domestic, agricultural, and industrial water in the Jordan River Valley.

Levels of sodium, sulfate, chloride, iron, total dissolved solids, and uranium in the unconfined ground water downgradient (west-northwest) and beneath the tailings pile are greater than those in the upgradient unconfined ground water. No elevated levels of molybdenum (Mo), arsenic (As), selenium (Se), radium (Ra-226 and Ra-228), vanadium (V), thorium (Th-230), and lead 210 (Pb-210), attributable to the tailings pile, have been found downgradient of the pile boundary.

Elevated levels of iron, sulfate, and chloride were found in the confined aquifer water beneath and downgradient of the pile boundary. None of the radionuclides and metals listed above, which would be associated with the tailings pile, were found in levels above background in the confined aquifer water. These constituents are less mobile than the sulfates and chlorides and probably were adsorbed or precipitated in the low permeability clay and silt layers in the unconfined aquifer or aquitard.

The relatively good water quality of the artesian aquifer in the Salt Lake area is maintained by the upward vertical hydraulic gradient between the

two aquifers which prevents downward migration of the naturally occurring brackish unconfined aquifer. Current utilization (pumping) of the confined aquifer in the Salt Lake City area has not significantly reduced the areal extent of the flowing artesian conditions which are present in the valley or the head levels of the aquifer as compared to levels measured in the early 1900's (Hintze and Miller, 1975), and as such, this upward gradient has been and is currently maintained in the Salt Lake area. Much heavier utilization of the artesian aquifer would reduce the head levels and possibly reverse the upward vertical hydraulic gradient. This condition would then cause downward flow of the brackish unconfined aquifer waters. The presence of the several feet of confining clay and silt layers would retard flow to low velocities if the vertical hydraulic gradient were reversed; however, the downward driving force would be present.

The migration of the unconfined aquifer waters to the confined aquifer would increase the dissolved solids levels even in areas well away from any possible influence from the tailings pile. This condition would degrade the artesian water and it could eventually make it non-potable. Thus, this scenario will restrict the long-term, heavy utilization of the confined aquifer, irrespective of the contamination noted in the unconfined aquifer system associated with the tailings pile.

The evidence of elevated iron, chloride, and sulfate in the confined aquifer beneath and downgradient of the pile probably reflects the condition involving localized heavy utilization of the confined aquifer. Heavy pumping during operation of the Vitro plant may have lowered the head levels of the artesian system and reversed the direction of the vertical flow.

The analytical analyses of the background wells in the unconfined aquifer (presented in Appendix D) generally show that concentrations of chloride, sulfate, and total dissolved solids are in excess of the EPA secondary drinking water standards. In addition, some of the background samples contained iron and arsenic in excess of the EPA secondary and primary drinking water standards, respectively.

The background water quality of the confined aquifer is generally in compliance with the primary EPA drinking water standards except for total dissolved solids which are around 300 ppm. This value is, however, less than the upper limit for the EPA's secondary drinking water standard.

South Clive site

The South Clive site is located within the Great Salt Lake Desert. The two major ground-water systems in the area are the valley fill and the alluvial fans bordering the Desert. Recharge to the alluvial fans occurs in the mountains bordering the Desert; in the vicinity of the site this would be the Cedar Mountains east of the site. It is believed that ground water in the alluvial fans recharges the valley fill. Direct infiltration of incident precipitation is not believed to be a significant component of the total ground-water regimen at the South Clive site.

Ground-water levels measured in monitoring wells installed at the South Clive site vary from about 20 to 30 feet below the ground surface. The

principal direction of ground-water flow within the South Clive region is to the west. Locally, however, the direction of ground-water flow is modified by both the surface topography and by the stratigraphy at depth. Within the South Clive site, the direction of ground-water movement appears to be mainly to the northeast. The hydraulic gradient in this direction is small, approximately 3 feet per mile.

The permeabilities of valley-fill materials beneath the South Clive site range from about 0.28 to 2.8 feet per day, which are consistent with the interbedded very fine- to fine-grained sands and clays. The calculated transmissivities from the results of pumping tests conducted on the site ranged from 0.8 to 166 ft² per day with a mean value of approximately 40 ft² per day.

Ground-water samples from each of the five monitoring wells installed at the South Clive site were obtained and analyzed for major cations and anions, metals, and radiochemistry. The analytical results for samples from each of the five wells were compared with the EPA primary and secondary drinking water standards. Sulfate, chloride, and total dissolved solids (TDS) concentrations in all wells exceeded the EPA secondary drinking water standards. Total hardness was high, indicating that the ground water is hard to very hard. This is supported by the reported high concentrations of calcium, bicarbonate, sodium, and magnesium. Based on reported total dissolved solids levels, the ground water at the South Clive site is classified as "briny" (Hem, 1970). In two or more wells, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver exceeded EPA primary drinking water standards; iron and manganese exceeded EPA secondary drinking water standards. Analytical results for the radionuclide parameters indicate that gross alpha, gross beta, and uranium oxide (U₃O₈) exceeded EPA's drinking water standards in two or more of the wells.

Other than the five monitoring wells installed for this program, there are no existing ground-water wells on or near the South Clive site. The closest known wells to the South Clive site are approximately 3 miles northwest and 3.4 miles east. The well west of the site has been destroyed; one of the two wells east of the site is in current use to water livestock--the second well was destroyed (see Table D-32, Appendix D). The high salinity of the ground water in the South Clive area may limit its use without treatment to industrial uses. In the Bonneville Salt Flats to the west, high salinity ground waters are used for mineral extraction.

4.7 ECOSYSTEMS

The existing ecosystem of the Vitro site and that for the South Clive site are described below in terms of soils, vegetation, wildlife, and endangered species. These descriptions are based both on literature and on field surveys.

4.7.1 Soils

The soil survey of the Salt Lake Area (SCS, 1974) listed Chipman silty clay loam, saline alkali, and Ironston loam as the principal soils of the Vitro site. The Vitro site is now covered by unconsolidated tailings material.

The U.S. Soil Conservation Service (SCS, 1981) described and mapped the soil of the South Clive site as Iosepa silt loam. Because this soil unit is the only soil delineated on the site, no soil map is included here.

General characteristics

The soil at the South Clive site is classified as having a horizon of clay and alkali (sodium) accumulation. The soil lacks moisture for plant growth for long periods and is low in organic matter (USGS, 1970). Soils of this type are periodically saturated with water in some subhorizon within 1 meter of the surface (SCS, 1975a).

When the surface soils are dry, as they are most of the time, they are powdery and easily lofted into the air by wind action or traffic of any kind. The wind erosion group to which they are assigned by the SCS is 4L, Moderate. Such a soil can lose as much as 86 tons per acre/year (Craig and Turelle, 1964), which is equivalent to a foot of surface soil being removed by wind in 24 years.

Physical and chemical properties

Soil samples were collected from a trench located in the NW corner of the South Clive site. Soil samples were also obtained from soil cores in each of the four corners, in the center of the site and surrounding adjacent area. Laboratory analysis of physical and chemical properties are listed in Table 4-2.

The highly saline, slowly permeable soils in this extremely arid location are unsuitable for re-establishing a lasting, self-sustaining vegetation to protect the soil covering the disposed materials. Even if the low precipitation could be overcome by irrigation, the nature of the soils would impose insurmountable problems that would prevent satisfactory plant cover within 10 to 20 years.

The high clay content at depths of 4 to 15 inches (Table 4-2) and the sodium content combine to give the South Clive site soils natural properties for compaction (USDA, 1954) to form an impervious soil layer. The highly toxic sodium concentration will act as a barrier to all but the most shallowly rooted plant species, and the density of the clay will deter burrowing by animals. In addition to plant growth inhibitory properties listed in Table 4-4, boron was present in levels that are hazardous for plant growth.

The soil of the site has properties that make it unsuitable for most plant growth and, therefore, for revegetation in land reclamation.

Table 4-2. Physical-chemical properties of soils at the South Clive site and vicinity.

Sample number	Depth	pH	EC ^a mmhos per cm	Saturation percent	Particle size percentage			Soil texture	OM % ^b	Milliequivalents per liter			SAR ^c
					Sand	Silt	Clay			Sodium	Calcium	Magnesium	
1 ^d	0-4"	7.8	24	37.2	29.2	45.6	25.2	Loam	1.70	227	27.8	9.5	53
2 ^e	0-4"	8.1	23	40.1	31.2	44.8	24.0	Loam	2.09	234	10.7	6.1	81
1	4-7"	8.1	19	45.4	29.0	43.2	27.8	Clay Loam	1.96	180	8.2	3.4	75
2	4-7"	8.4	22	52.8	24.0	40.0	36.0	Clay Loam	1.63	237	6.0	4.7	102
1	7-15"	8.2	24	51.6	21.0	47.2	31.8	Clay Loam	1.61	222	7.8	5.9	85
2	7-15"	8.5	26	62.3	26.0	43.0	31.0	Clay Loam	1.51	278	6.1	6.8	109
1	15-24"	8.2	30	68.7	23.2	58.0	18.8	Silt Loam	1.40	289	13.0	13.0	80
2	15-24"	8.6	23	97.5	17.0	80.0	3.0	Silt	1.23	241	4.6	6.3	103
1	24-31"	8.1	53	66.8	18.6	76.0	5.4	Silt Loam	1.25	469	31.0	34.0	82
2	24-31"	8.3	33	93.7	17.0	81.0	2.0	Silt	0.91	335	21.8	17.6	76
1	31-51"	8.1	63	77.3	8.2	84.6	7.2	Silt	1.32	559	25.4	38.0	99
2	31-51"	8.3	40	78.6	9.0	85.0	6.0	Silt	1.06	421	40.5	23.5	74

^aEC = Electrical conductivity.^bOM = Organic matter.^cSAR = Sodium adsorption ratio.^dSample 1: soil obtained from diagnostic horizons from excavated trench.^eSample 2: soil obtained from 5 cores with soil samples composited from depths corresponding to Sample No. 1.

The 5 cores were taken from each corner and center of Section 32, South Clive site.

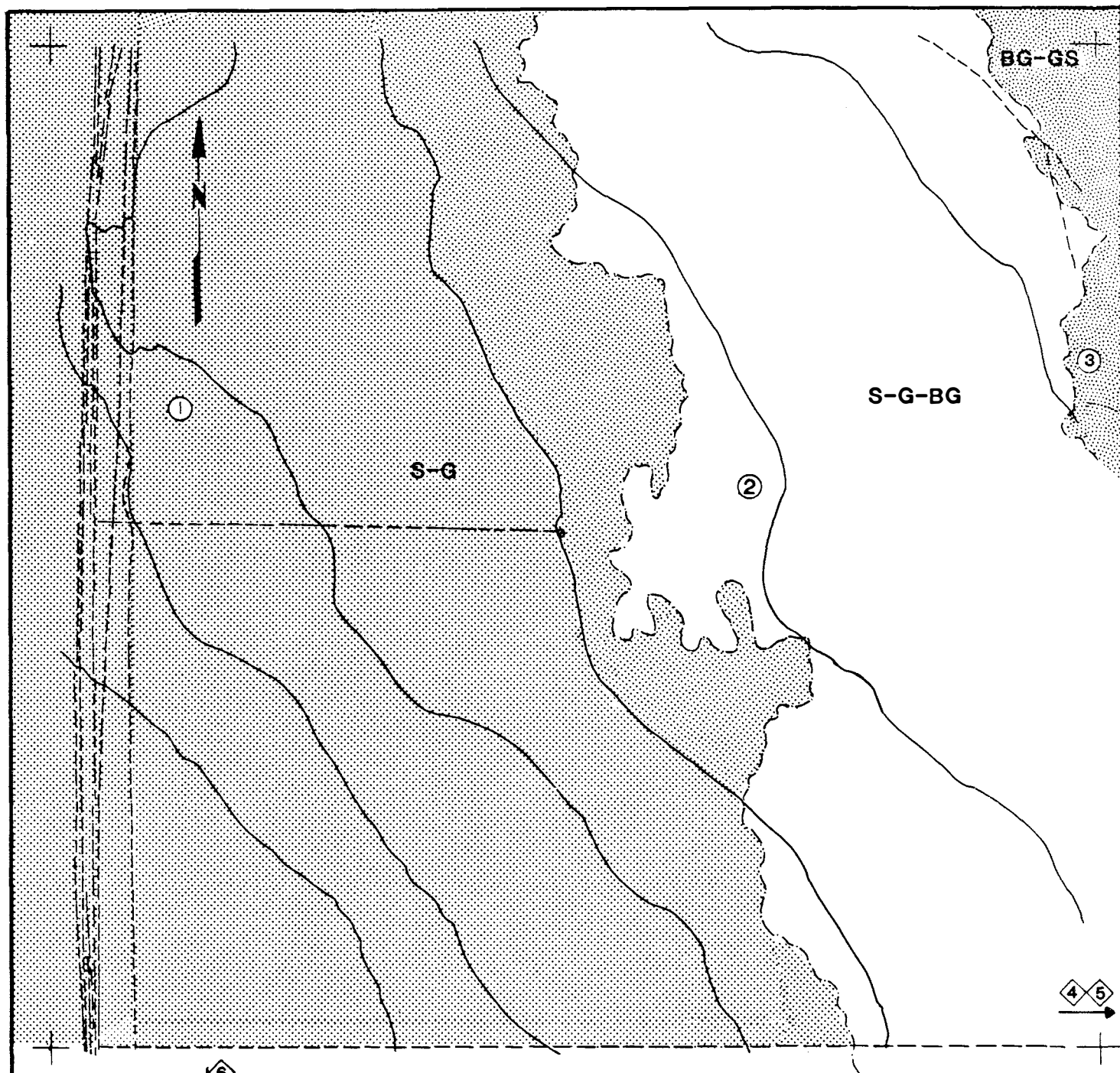
4.7.2 Vegetation

The vegetation of the South Clive site is a homogeneous, semi-desert low shrubland, primarily composed of shadscale (Atriplex confertifolia). The shrubland is part of the Northern Desert Shrub Biome of the Cold Desert Formation (Oosting, 1956) and has been described by Kuchler (1964) as a Saltbush (Shadscale)-Greasewood Shrub complex. Plant communities identified on the site are Shadscale-Gray Molly (Kochia americana var. vestita), a transitional community type of Shadscale-Gray Molly-Black Greasewood (Sarcobatus vermiculatus), and Black Greasewood-Gardner Saltbush (Atriplex nuttallii). Vegetation patterns of the South Clive site are correlated with soil salinity and corresponding shifts in presence or abundance of species. All three communities are low in species diversity. Seep-weed or inkweed (Suaeda torreyana) and scattered perfoliate pepperweed (Lepidium perfoliatum) are the only prominent understory species of the Shadscale-Gray Molly community. This community occurs over most of the South Clive site, although black greasewood becomes prominent enough on the eastern quarter to form a Shadscale-Black Greasewood-Gray Molly community. Except for black greasewood and occasional stands of halogeton (Halogeton glomeratus) the composition is similar to the more prominent Shadscale-Gray Molly community.

The Black Greasewood-Gardner Saltbush community type is floristically the most diverse, but only occurs in the extreme northeast corner and eastern edge of the South Clive site (Figure 4-8). In addition to Gardner saltbush, the flora is composed of all species found in the other communities except halogeton.

The South Clive site occurs in the Desert Alkali range site, which is rated by the Bureau of Land Management (BLM) as being poor for grazing or forage production (Olsen, F., Range Conservationist, BLM, Salt Lake City, Utah, personal communication, April 9, 1981). However, the vegetation forms an important ground cover and deterrent to soil erosion, and provides habitat for wildlife species. Annual production of the three community types ranged from 152 to 517 pounds per acre, air dry. Annual production for the range site is given as 50 to 200 and 500 to 1500 pounds per acre during unfavorable and favorable years respectively (SCS, 1975b). Livestock carrying capacity with such production would range from 3 to 80 acres per animal-unit month.

The vegetation of the Vitro site is characterized as early successional and, although quite sparse because of disturbance, is relatively diverse. Species noted on the site include reed (Phragmites spp.), alkali muhly (Muhlenbergia asperifolia), alkali sacaton (Sporobolus airoides), saltgrass (Distichlis spp.), cattail (Typha spp.), bulrush (Scirpus spp.), filaree (Erodium cicutarium), reed fescue (Festuca aurundinacea), white top (Cardaria draba), rubber rabbitbrush (Chrysothamnus nauseosus), horseweed (Conyza spp.), thistle (Cirsium spp.), fox tail barley (Hordeum jubatum), cheatgrass brome (Bromus tectorum), Russian thistle (Salsola kali), tamarisk (Tamarix pentandra), and Siberian elm (Ulmus pumila).



LEGEND

- S-G SHADSCALE-GRAY MOLLY
- S-G-BG SHADSCALE-GRAY MOLLY-BLACK GREASEWOOD
- BG-BG BLACK GREASEWOOD- GARDNER SALT BUSH
- ① SAMPLE PLOT
- ④ OFF-SITE SAMPLE PLOT

BASE MAP REFERENCE:
AERO-GRAPHICS, INC. , SALT LAKE CITY
UTAH

SCALE:
1 INCH EQUALS
APPROXIMATELY 750 FEET

FIGURE 4-8
VEGETATION MAP OF THE SOUTH CLIVE SITE

4.7.3 Terrestrial wildlife

No wildlife studies have been conducted on the Vitro site for purposes of this document. However, earlier studies commissioned by Ford, Bacon, Davis Utah Inc. (FBDU, 1980) developed a list of 24 mammalian and 39 avian species that would normally be found in association with the plant life on the Vitro site. The predominant mammals are the black-tailed jackrabbit, Townsend ground squirrel, Ord's kangaroo rat, western harvest mouse, deer mouse, and striped skunk. The predominant avian species are the killdeer, California gull, cliff swallow, Brewer's sparrow, house sparrow, western meadowlark, and black-billed magpie. While amphibians and reptiles are not identified, they are undoubtedly represented on the site.

Two habitat types (shadscale flats and greasewood) described by Egoscue (1962) occur on the South Clive site. Animal species typical of the site include black-tailed jackrabbit (Lepus californicus), deer mouse (Peromyscus maniculatus), horned lark (Eremophila alpestris), and desert horned lizard (Phrynosoma platyrhinos); species diversity is low. All of these animal species could use the site for breeding or nesting. Jackrabbits, deer mice, and grasshopper mice (Onychomys leucogaster) were the only mammals collected during field surveys for this EIS.

4.7.4 Aquatic biota

Aquatic ecosystems do not occur on or near the South Clive site, although surface water is present along the transportation corridor and near the Vitro site. The aquatic ecosystems of the latter areas have not been studied.

4.7.5 Endangered and threatened species

No threatened or endangered plant species are known to occur in the Salt Lake Valley (U.S. F&WS, 1980). No threatened or endangered animal species are known to occur on the Vitro site, and none would be expected since the site is located in a major urban area.

No important plant or animal species, as defined by NRC (1980), are known to occur on the South Clive site and no known important habitats have been identified in the area (Olsen, F., Range Conservationist, BLM, Salt Lake City, Utah, personal communication, April 9, 1981; Day, D., Director Utah Division of Wildlife Resources, letter dated 27 March 1981).

No threatened or endangered plant species are known to occur in the vicinity of the South Clive site. The Great Basin fishhook cactus (Sclerocactus pubispinus) is currently under review for threatened status (U.S. F&WS, 1980). This species is associated with gravelly beach terraces of Pleistocene Lake Bonneville in western Tooele County and is not expected to occur in the Clive area (Welsh and Thorne, 1979; Tisdale, J., Acting Area Manager, U.S. F&WS, Salt Lake City, Utah, letter dated May 12, 1981).

Similarly, no threatened or endangered animal species are known to occur on the South Clive site (Tisdale, J., Acting Area Manager, U.S. Fish and Wildlife Service, Salt Lake City, Utah, letter dated May 12, 1981). However, the Utah Division of Wildlife Resources (Day, D., Director, Utah Division of Wildlife Resources, Salt Lake City, Utah, letter dated 27 May 1981) reports that the area is used for foraging by bald eagles (Haliaeetus leucocephalus) during the winter.

4.8 RADIATION

The radiation environment at and near the Vitro site, the South Clive site, and the transportation corridors is summarized in this section. The radiological units of measure are picocuries (pCi) or microcuries (μ Ci) per liter (l) or gram (g). Radiological dose rates and exposure are presented in microroentgens/hour (μ R/hr) and millirem/year. For purposes of this EIS and considering the type of radiation, the roentgen and rem may be considered equivalent.

The radiation environment currently at the Vitro site, the South Clive site, and the transport corridor between the two sites has been obtained from the literature and from field monitoring programs. A more extensive discussion of the radiation environment and radiological matters in general is provided in Appendix F.

4.8.1 Vitro site

The environmental radiological levels for the area surrounding the Vitro site have been characterized in previous studies (EPA, 1975; FBDO, 1981; ORNL, 1977; MSRD, 1982; BFEC, 1983).

Radioactive airborne particulate concentrations were measured in the vicinity of the tailings piles at the Vitro site by the EPA (1975). The average airborne radionuclide concentrations were determined at the CVWRF sewage-treatment plant No. 1 (approximately 0.1 mile north of the southeast tailings area) following a one-year sampling period during which 26 consecutive two-week samples were collected and analyzed. Average concentrations of the nine radionuclides reported at this location ranged from 6.5×10^{-5} pCi/l (Po-210) to 2.5×10^{-8} pCi/l (U-235).

Several studies to determine ambient-air radon concentrations near the Vitro site have been undertaken (FBDO, 1981; ORNL 1977, Scheerer and Sills, 1969; Monsanto, 1983). The only long-term measurements are those done by Monsanto using Passive Environmental Radon Monitors (PERMs). Forty sampling locations in the vicinity of the Vitro site were used to define the average ambient radon concentrations. These averaged about 3 pCi/l at the edge of the site and decreased to background concentrations (roughly 0.25 pCi/l) at distances of 1 to 2 miles from the site.

Gamma radiation levels have been measured and found to decrease rapidly with distance from the tailings pile. On the pile itself gamma radiation levels range from 100 to 1200 $\mu\text{R/hr}$. At 0.1 mile from the edge of the pile the gamma radiation level has fallen to 45 $\mu\text{R/hr}$, and at 0.5 miles from the pile the gamma radiation level has reached background for Salt Lake City--about 12 $\mu\text{R/hr}$ (FBDU, 1976 and 1981). The range of typical background values is 9 to 17 $\mu\text{R/hr}$ (FBDU, 1976).

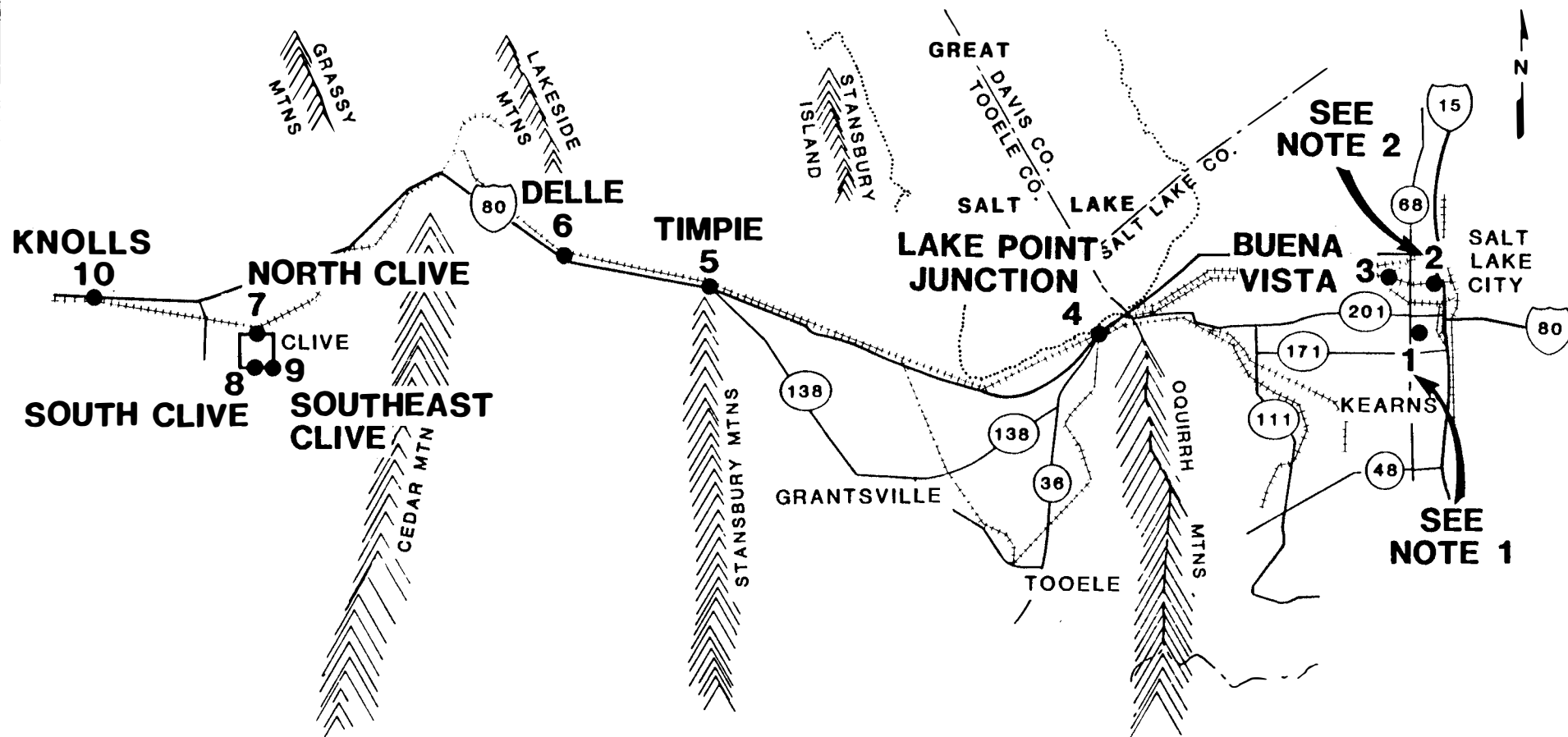
Background concentrations of radionuclides in soils have been measured in and around Salt Lake City by a number of investigators (ORNL, 1977). Results are generally comparable and are typified by the ORNL results, which indicate the following values (geometric mean plus or minus geometric standard deviation): Ra-226, 1.5 ± 1.2 picocuries per gram, and U-238, 2.0 ± 3.6 picocuries per gram. In addition, soil samples were collected by ORNL (1977) from 58 locations within about 400 to 1000 meters of the (south) sediment pile and analyzed for radioactivity. Samples were collected at the surface and at one foot depth and were analyzed for Ra-226. Concentrations in surface samples ranged from background levels (about 1 pCi/g) away from the pile to over 100 pCi/g of Ra-226 near the pile. On the site, the highest observed concentration was 560 pCi/g. Samples obtained from the one-foot depth ranged from background to 460 pCi/g of Ra-226.

On the pile, a statistically designed sampling program conducted by Mountain States Research and Development (MSRD, 1982) has resulted in pile-averaged values of 40 pCi/g U-238, 560 pCi/g Ra-226, and 560 pCi/g Th-230. The latter two radionuclides were measured in the MSRD samples by Bendix Field Engineering (BFEC, 1983).

Sediment samples from the Jordan River, Mill Creek, and the Vitro drainage ditch were collected and analyzed for U-238, Th-230, Ra-226, and Pb-210 (ORNL, 1977). Results showed no contamination in Jordan River sediments, and slightly elevated levels (roughly twice estimated background) in Mill Creek sediments. The drainage ditch sediments, however, were shown to contain relatively elevated concentrations of all three radionuclides. Ra-226 concentrations range from 60 to 120 pCi/g, while Th-230 concentrations ranged up to 284 pCi/g which was higher than any other reported radionuclide.

4.8.2 The South Clive site

Radiation levels currently existing at the South Clive site have been determined from monitoring programs conducted by Dames & Moore and Argonne National Laboratory (ANL). Monitoring has also been conducted at two additional points near Clive, one to the north and one to the southeast (Figure 4-9). The data described below are the result of 3 months of monitoring (December 1981 through February 1982).



NOTES

1. SWITCHYARD JUST NORTH OF VITRO SITE
2. TWO MILES NORTH OF VITRO SITE

FIGURE 4-9
LOCATIONS OF RADIOLOGICAL MONITORING STATIONS

Using the track etch method, ANL measured ambient air concentrations of Rn-222 at the three locations surrounding Clive. The 3-month average Rn-222 concentration at the South Clive site was 0.31 pCi/l. All of the values obtained for the Clive area were below 1 pCi/l.

A general survey of terrestrial and cosmic gamma radiation levels was also conducted by ANL in the area surrounding Clive. These radiation levels should be compared with the gamma radiation levels found on the Vitro site. The measurements were performed quarterly using thermoluminescent dosimeters (TLDs). During the 3-month period, the average exposure rates for Clive-South, Clive-Southeast, and Clive-North were 16.2, 14.1, and 11.6 μ R/hr respectively.

Surface-soil samples (to a depth of 5 centimeters) were collected at 300-meter intervals in each of eight compass directions out to a distance of 1500 meters from the center of the South Clive site. All of the samples were analyzed for Ra-226. Samples collected 1500 meters from the center were also analyzed for Th-230, U-238, and Pb-210. The surface-soil radionuclide concentrations found at the South Clive site are in secular equilibrium, with the exception of slightly elevated concentrations of Pb-210 probably due to atmospheric deposition. The surface-soil concentrations of Ra-226 ranged from 0.9 to 1.2 picocuries per gram dry weight (pCi/g); those of U-238 ranged from 0.7 to 1.0 pCi/g; those of Th-230 ranged from 1.2 to 1.6 pCi/g; and those of Pb-210 ranged from 1.1 to 2.3 pCi/g. These concentrations agree with the approximately 1 pCi/g average for surface soils of the contiguous United States (LASL, 1978).

Subsurface-soil samples were collected at the center of the South Clive site and at a distance 750 meters from the center in each of the four compass directions and at 3 depth intervals. The ranges of radionuclide concentrations found in samples from 0 to 20 cm, 40 to 60 cm, and 80 to 100 cm depths were not significantly different from the ranges of radionuclide concentrations found in the surface-soil samples.

Samples of vegetation and wildlife taken near the South Clive site were assayed to determine natural radionuclide concentrations in the local biota. These results show vegetation concentrations averaging 5.4 pCi/kg (wet wt.) for uranium, 6.0 pCi/kg (wet wt.) for Th-230, 3.1 pCi/kg (wet wt.) for Ra-226, 198.0 pCi/kg (wet wt.) for Pb-210, and 48.0 pCi/kg (wet wt.) for Po-210. The greater concentrations of Pb-210 and Po-210 are attributed to atmospheric deposition of these radon daughters.

The results of analyses on rabbit flesh show a similar pattern with the averages for U-238, Th-230, and Ra-226 being 0.5, 0.5, and 0.6 pCi/kg (wet wt.), respectively. The Pb-210 and Po-210 averages were 4.0 and 8.0 pCi/kg (wet wt.), respectively.

4.8.3 The transportation corridor

The radiation environments currently existing along the transportation route from the tailings piles at Vitro to the South Clive site have also been monitored by Dames & Moore and ANL. The Delle and Knolls monitoring sites are located on the transport corridor (see Figure 4-9).

The 3-month average ambient-air Rn-222 concentrations at the Delle and Knolls sites were 0.35 pCi/l and 0.23 pCi/l, respectively.

Ambient gamma exposure rates were measured at four locations along the transportation routes (see Figure 4-9). Integrated external exposure rate measurements were performed quarterly using thermoluminescent dosimeters. The average exposure rates were 12.8 μ R/hr at Lake Point Junction, 15.1 μ R/hr at Timpie, 10.0 μ R/hr at Delle, and 10.2 μ R/hr at Knolls.

The radionuclide concentrations in the soil along the transportation routes were evaluated by obtaining and analyzing soil samples taken at the Delle and Knolls sites. These samples were analyzed for U-238, Ra-226, Th-230, and Pb-210. The analyses show that the surface-soil concentrations of these radionuclides at Delle and Knolls are not significantly different from the corresponding values measured at the South Clive site.

4.9 LAND USE

Regional land-use patterns are very different in heavily urbanized Salt Lake County and the more rural Tooele County. Salt Lake County population is almost entirely urban; 99.1 percent of its population lived in urban areas according to the 1980 census compared to 72.0 percent in Tooele County. The Federal government owns and controls the greatest percentage of land in Tooele County, 82.6 percent of the county land area of 4.43 million acres. The greatest portion (1,948,417 acres) of the Federal land is public domain administered by the Bureau of Land Management (BLM). The U.S. Department of Defense controls the next greatest portion of 1,558,862 acres, with national forests occupying 152,223 acres (Utah State Department of Agriculture, 1981). These and other differences between the two areas are indicated in Table 4-3.

Table 4-3. Land use and ownership for Tooele County, 1970, and Salt Lake County, 1976

Use or ownership	Tooele County		Salt Lake County	
	Acres	Percent of total	Acres	Percent of total
Federal land	3,659,502	82.6%	110,335	22.6%
Residential and accessory use	1,546	0.0	32,614	6.7
Commercial	240	0.0	4,342	0.9
Industrial	50,885	1.2	14,924	3.1
Agriculture	39,776	0.9	58,041	11.9
Other private lands	425,107	9.6	na ^b	
State lands (no highways)	218,640	4.9	4,286	0.9
Highways, roads & streets	13,651	0.3	23,079	4.7
Railroads	3,000	0.1	na	
Indian land	17,763	0.4	0	
Public & quasi-public, in municipalities	588	0.0	na	
Small waters (excluding all of more than 40 acres) ^a	22	0.0	243	0.0
Totals	4,430,720	100.0%	488,960	100.0%

^aWater areas of 2 to 40 acres and streams less than 0.125 mile in width.

^bna = not available.

Source: Mountain Area Planners, 1972; Utah State Department of Agriculture, 1981.

4.9.1 Vitro site

The entire 128-acre Vitro site is owned by the CVWRF Board, operator of the sewage treatment plant to the north of the site. Land ownership in the vicinity of the site is predominantly private. Local land owners include the Denver & Rio Grande Railroad Company, Zions Utah Bancorporation, Paul W. Buehner, Jr., the Utah State Retirement Fund, American Smelting & Refining, Westerners, Inc., Petersen Investors and Western Dry Mix. The status and ownership of the 5.4-acre industrial tract on the southwest side of the Vitro site are described in Section 4.2.1.

Historic land use

The Vitro site was used for an alumina plant during World War II. That plant was converted to produce uranium beginning in May 1951, and sold the output to the Atomic Energy Commission under procurement contracts until February 1964. The plant was then converted to produce commercial vanadium, operating until July 1968. Plant demolition was completed during 1970.

The site is part of a 1979 annexation by the City of South Salt Lake of a portion of unincorporated Salt Lake County. Land use within a 0.5-mile radius of the site began to change from predominantly agricultural and vacant to other uses in 1979. In 1974, a construction moratorium imposed by the Salt Lake City-County Board of Health banned construction within a 0.5-mile radius of the site. This ban was lifted in 1979.

Present land use

The CVWRF sewage-treatment plant No. 1 is located north of the Vitro site (see Figure 4-10). This facility has been in operation since its initial construction in 1954. The present land use within 0.5 mile of the Vitro site boundaries is as follows (FBDU, 1981):

<u>Land use</u>	<u>Percent of area within 0.5 mile of the site (503 acres)</u>
Residential	6%
Commercial	5
Industrial	18
Transportation/utility	28
Agriculture	16
Vacant (excluding Vitro site)	27

About 500 people occupied the residential areas within 0.5 mile of the Vitro site in 1980 (FBDU, 1981). The nearest residences to the Vitro site appear to be about 300 feet away from its southwestern corner, across 3300 South Street (see Figure E-2 in Appendix E).

Future land use and development

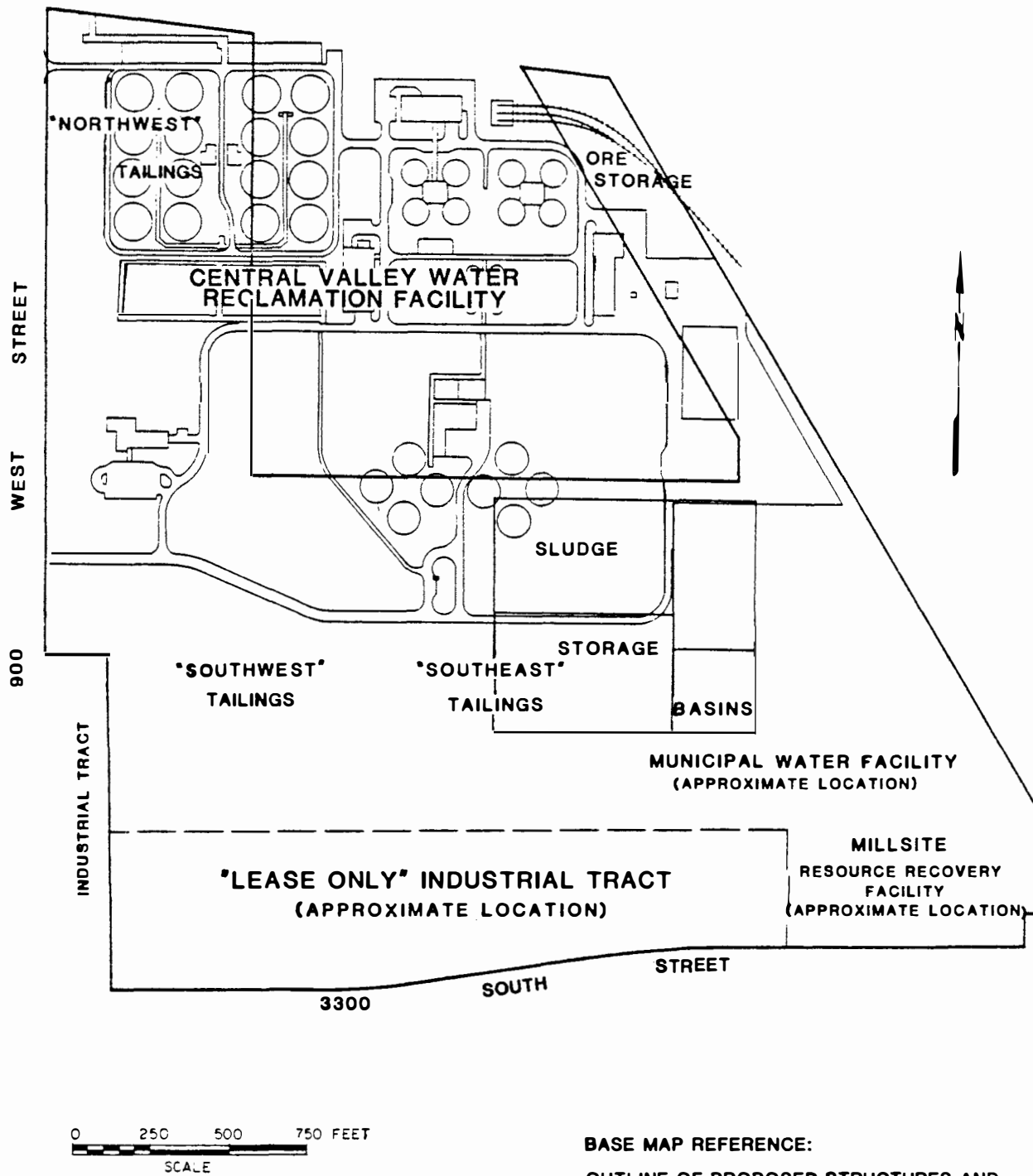
The CVWRF Board, which owns the 128-acre site, has indicated that several projects involving the site are planned (personal communication from Mr. Rodney Dahl, CVWRF Board, April 1982). Figure 4-10 shows the location of these projects.

The existing sewage-treatment facility is being expanded to a capacity of 50 million gallons per day (mgd). A further expansion to a capacity of 100 mgd is planned around the year 2000. Access roads and sewage pipelines will be extended by about 300 feet onto the tailings area.

A plan currently under consideration is to create a temporary industrial park on a 300-to-500-foot-wide strip of property along 3300 South Street. The property would be on a "lease only basis" to allow future development. In the meantime, the industrial park would provide lease revenue to the CVWRF Board.

The Wasatch Front Regional Council is currently considering leasing 10 to 15 acres of land in the area formerly occupied by the Vitro mill for a Resource Recovery Facility which would burn solid waste to generate electricity.

NOTE:
FOR COMPARISON WITH EXISTING CVWRF
FACILITIES SEE FIGURES 3-2 AND 3-3



BASE MAP REFERENCE:
OUTLINE OF PROPOSED STRUCTURES AND
OTHER FACILITIES FROM COON, KING AND
KNOWLTON ENGINEERS, SALT LAKE CITY, UTAH

FIGURE 4-10
CVWRF PROPOSED SITE DEVELOPMENT

There are several wells at the site near the old mill. The quantities and qualities of water vary from well to well. Present plans call for a portion of the water to be utilized by the local municipal system. A small portion of the site would be required for the facilities to handle the water.

Finally, the CVWRF is in need of space for sludge-storage basins and sludge disposal. Future sludge-storage basins would extend into what is now the southeast tailings area, which is currently being used for sludge disposal.

The City's Master Plan contains estimates of the absorption of vacant land zoned for industrial use in South Salt Lake. The "high estimate" projects that between 82 and 84 percent of the City's available industrial acreage will be absorbed by 1990. This development scenario assumes the following "major economic stimuli": (1) deployment of the MX missile system in western Utah; (2) increased extraction of coal reserves in Utah's Overthrust Belt; and (3) continued development of statewide water and power projects. The "low estimate" assumes a moderate national and/or regional recession. Under this scenario, 58 percent of the available industrial land will be absorbed by 1990. Because of the low average income of the city's population, as well as its proximity to the Salt Lake City business district, retail and commercial development in the future are expected to be minimal. South Salt Lake's forecasted growth will be predominately in wholesaling, distribution, and office/warehouse (70 percent) and industrial uses (16 percent), with the remaining 14 percent being a combination of retailing, office and service businesses (Vanwagoner and Associates, 1980). It is generally agreed by the CVWRF Board, South Salt Lake and Salt Lake County officials that the "highest and best" use for the area is primarily in wholesaling and warehousing functions.

4.9.2 South Clive site

The South Clive site is owned by the State of Utah. Most lands within a 10-mile radius are public domain administered by the BLM, with scattered lands owned by the State of Utah or privately.

Present land use

Lands within a 10-mile radius of the South Clive site are rarely used, because of their remoteness from urbanized areas, the poor soil conditions, and sparse vegetation characteristic of the region. Sheep grazing and recreational-vehicle driving are the primary uses made of the area but such uses are apparently light. A state grazing lease is held for the site itself (Section 32, Township 1 South, Range 11 West) by the Skull Valley Company. Numerous trails in the area indicate that it has been used on occasion for recreational vehicle purposes. The only other use of lands within a 10-mile radius is for transportation. The Interstate 80 highway and the Union Pacific railway pass 2.5 miles and 1 mile north, respectively, of the site.

Future land use and development

Factors that could cause land-use changes in the South Clive site vicinity in the intermediate to long-range future include: development of crops that are salt-resistant through genetic engineering and economical means of growing them; a Federal decision to use the area for defense purposes; or other major changes in technology, raw materials requirements, or other societal support functions that cannot be foreseen at this time.

Given existing technologies, however, development of the area for any purpose appears unlikely because of its unproductive soil, and its remoteness from population centers.

4.10 AMBIENT SOUND LEVELS

Humans can hear a large range of sound pressures. The decibel (dB) is used to express these sound levels over a wide physical range. The human ear does not perceive sound at low frequencies in the same manner that it does at higher frequencies. Sounds at low frequency do not seem as loud as those of equal intensity at higher frequencies. The A-weighting network is provided in sound analysis systems to simulate the human ear. A-weighted sound levels are expressed in units of decibels and are used throughout this section unless noted otherwise.

Several Federal agencies have established guidelines and standards for sound level emission (noise). These agencies have also recommended ambient sound levels for public health. The EPA (1974) recommended a 70 dB L_{eq} (24) exposure limit (ambient sound level) as a guideline for continuous exposure and a 55 dB (L_{dn}) as the level where ambient noise is an annoyance to outdoor activity. These are only guidelines and not regulatory standards. ($L_{eq}(24)$ represents the sound energy averaged over a 24-hour period while L_{dn} represents the L_{eq} with a 10 dB increase for noise that occurs at night.) The Federal Highway Administration (1976) established a 70-decibel standard for noise levels during the peak hour of traffic. This standard is used as an indication of what is an acceptable limit for highway noise. The EPA (1976 a,b) established noise emission standards for various types of construction equipment, railroad operations, and specific vehicles. These are true standards which must be met by the manufacturer and maintained by the operator.

No measurements of ambient sound levels were made at the Vitro or South Clive sites; instead, sound levels were characterized at these sites on the basis of proximity to highways and industrial areas, and the like, according to typical values of ambient sound levels that have been measured in similar situations (National Academy of Sciences, 1977).

Vitro site

Ambient sound levels were determined by the existing land uses and by the area's population density. The predominant land use in the area is

transportation/utility (28 percent) and vacant (27 percent). The population density in the area within 0.5 miles of the site is about 630 people per square mile. The area of interest is crossed by I-15, secondary roads, and the railroad. Based on the area's population density the ambient day-night sound level (L_{dn}) would be about 50 decibels, as shown in Table 4-4. Actual ambient sound levels at the residential area to the east of the site, however, are higher because I-15 contributes significantly to area sound levels. It is estimated that the day-night sound levels experienced by populations residing to the east of the site range from about 65 dB for homes nearest to I-15 to 50 dB for locations further from the highway.

Table 4-4. Typical values of day-night sound levels, L_{dn} ^a

Land use description	Population density (people/mi ²)	L_{dn} - dB
Rural, undeveloped	20	35
Rural, partially developed	60	40
Quiet suburban	200	45
Normal suburban	600	50
Urban	2,000	55
Noisy urban	6,000	60
Very noisy urban	20,000	65

^aDay-night sound level (L_{dn}) is an EPA description of environmental sound. It is the average of daytime and nighttime A-weighted sound levels with nighttime sound given a penalty of 10 decibels.

Source: National Academy of Sciences, 1977.

Trailer courts along the Jordan River and residential areas to the south, west, and northwest are further from the Interstate I-15 but are closer to the site and adjacent industrial activity (see Figure 4-3 in FBDU, 1981). Day-night sound levels for these areas are estimated to be between 60 and 65 dB. The lower value is due to the local traffic, railroad, and I-15 contributions. The higher value is due to additional sounds contributed by the industrial activities including the water treatment plant. 3300 South Street is a major traffic artery generating high noise levels (Rodney Stone, South Salt Lake City Building Department, personal communication, June 1982).

The South Clive site

The area south of Clive is rural, undeveloped, and populated by few people. On the basis of population density, the day-night sound levels near the stabilization area will be less than 35 dB.

The transportation corridors

Sound levels along the transportation corridors outside of Salt Lake City are similar to those described above for the area south of Clive. Near I-80 (or along the corridors), day-night sound levels are estimated to be about 55 to 60 dB. At six hundred feet away from the highway, the sound levels should be about 35 to 40 dB.

4.11 SCENIC, HISTORICAL, AND CULTURAL RESOURCES

4.11.1 History

South Salt Lake was incorporated in 1938, primarily in order to apply for a Public Works Administration grant for Federal financial aid to build a sewer system. The population at the time of incorporation was 4000. In 1950, the town's first post office was built and it became a third-class city. The city's population had grown to 5000. South Salt Lake expanded its boundaries in 1955 by annexing to Eighth West Street. During the 1950s, the city grew and became a major industrial center, but by 1970, the city's residential population was declining. In 1979, the city annexed approximately 900 acres, extending its boundaries from Mill Creek to 3300 South Street and from the Jordan River to Seventh East Street, thereby increasing its population to 10,500. The daytime population increases to about 40,000 because of the large commercial-industrial sector of the city.

The South Clive site has probably been used for grazing since the early settlers. No events of historical significance are known to have occurred on the site. The Donner Trail probably passed north of the site, but the trail's exact location is unknown.

4.11.2 Scenic qualities

The vicinity of the Vitro site is in transition from a rural agricultural area to a commercial-industrial area with scattered residential development. Some grazing lands remain but many of these are being converted to warehouse and industrial uses. The dominant visual elements are the urban features that have recently been constructed (Interstate 15, the commercial-industrial area to the southeast of the site, and the warehouses located northwest of the site, for example) and the front range of the Wasatch Mountains.

The South Clive site is located in the Basin and Range physiographic province which covers nearly all of Nevada and parts of California, Oregon, Idaho, Arizona, New Mexico, and Texas. It is characterized by broad, flat basins occasionally interrupted by small mountain ranges. The area within a 10-mile distance of the South Clive site is typical of this province. Because of the flatness of the terrain, vistas of 30 miles are common.

The BLM Visual Resource Inventory and Evaluation system (BLM, 1978) was used to rate the scenic quality of the South Clive site relative to the physiographic province. This rating system employs a scale of 0 to 33, with higher ratings (19 or above) indicating that special management attention is required. This numerical rating system is shown below, with the ratings for the South Clive site underlined.

Scenic-Quality Rating

<u>Category</u>	<u>Score</u>		
	<u>High</u>	<u>Medium</u>	<u>Low</u>
Landform	5	<u>3</u>	1
Vegetation	5	<u>3</u>	<u>1</u>
Water	5	<u>3</u>	<u>0</u>
Color	5	<u>3</u>	<u>1</u>
Influence	5	<u>3</u>	<u>0</u>
Scarcity	6	<u>2</u>	<u>1</u>
Cultural modification	2	<u>0</u>	-4
	33 = maximum score		0 = minimum score

The total score of 12 for the South Clive Site is a low-to-medium rating for scenic quality, indicating that no special management attention is necessary.

4.11.3 Places of archaeological, historical, or cultural significance

No sites of archaeologic, historic, or cultural significance are known to exist at the Vitro mill site or within a 0.5-mile radius of it (see Appendix C of DOE, 1982).

On August 24-26, 1981, an intensive cultural resource inventory of an area inclusive of the South Clive site was conducted by the Archaeological-Environmental Research Corporation. No cultural resource sites were identified during the inventory but one isolated artifact was found. This artifact consisted of four pieces of broken purple glass from some unknown historic glass object. It does not appear that such a find indicates the existence on the site of significant archaeologic artifacts.

The Ground to Air Pilotless Aircraft Launch Site and Blockhouse is listed in the National Register of Historic Places and is approximately 10 miles west of Clive at Knolls. To the southeast of Clive (approximately 23 air miles) is the site of the Iosepa Settlement Cemetery. These are the historical sites closest to the transportation corridor between the Vitro and the South Clive sites.

4.12 SOCIOECONOMIC CHARACTERISTICS

4.12.1 Populations

According to the 1980 census (U.S. Department of Commerce, 1981), the state of Utah had a total population of 1,461,037, an increase of 37.9 percent since 1970. Most of the state's population (80.4 percent) lived in urban areas (places of 2500 or more), predominately on the Wasatch Front. The median age of Utah residents in 1980 was 24.2 years, lowest in the nation. "Baseline" population projections indicate that by the year 2000 the state could increase its total population to 2.3 million persons, 60 percent over that of 1980 (Utah State Planning Coordinator, 1981).

The populations of Salt Lake County and Tooele County increased by less than the state mean during the 1970-80 period, 35.0 and 20.8 percent, respectively. However, it is expected that approximately 65 percent of the state's growth to the year 2000 will occur in the Wasatch Front Multi-County Planning District, including Davis, Morgan, Salt Lake, Tooele, and Weber Counties (Utah State Planning Coordinator, 1981). The sources of demographic information in the following descriptions are the decennial census counts, unless otherwise indicated.

City of South Salt Lake

The population of South Salt Lake decreased at an average annual rate of 2.0 percent during the 1960-1970 period, from 9520 in 1960 to 7810 in 1970. It then grew by an average annual rate of 3.1 percent during the 1970s, reaching 10,561 in 1980. Virtually all of this growth between 1970 and 1980 was caused by expansion of the city's boundaries. South Salt Lake can be characterized as an area with small families, in life cycle stages either before or after the child-rearing stage. The proportion of families with incomes below poverty level in 1970 was 10.3 percent, higher than the statewide average of 9.2 percent.

Vitro site vicinity

Population counts were conducted for the area within 0.5 mile of the Vitro site by Ford, Bacon, & Davis Utah Inc. (FBDU, 1981). These counts indicated that 497 persons resided in the area, with average residential densities generally increasing with distance from the site. Average population density within 0.5 mile of the Vitro site was about one person per acre. Beyond 0.5 mile, density increased rapidly to 4.3 persons per acre within 2 miles. The daytime population increases to about 40,000 because of the large commercial-industrial sector of the city.

Tooele City

Tooele City's population grew from 9133 in 1960 to 12,539 in 1970, an average annual increase of 3.2 percent. In the following decade the growth rate decreased to 1.3 percent per year, to a 1980 city population of 14,335.

The average household size in Tooele City was 3.38 persons in 1970, slightly less than the statewide average. A relatively high proportion of its population was married (69 percent of males versus 56.6 percent for the state) and its birth rate (435 live births per 100,000 population) was about equal to the state average (436 live births per 100,000 population).

South Clive site

An estimated 25,526 people resided within 50 miles of the South Clive site at the time of the 1980 Census, but most of the area is uninhabited. The closest residents lived 15-20 miles to the northeast of the site. The largest number lived 30-50 miles to the east and southeast of the site in the Tooele-Grantsville area. Table 4-5 presents estimates of the 1980 population within 50 miles of the South Clive site by compass direction and radial distance.

Table 4-5. Population wheel for South Clive site

Direction	Miles from site									
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
N										
NNE										
NE										
ENE				7						
E					10		2,676	1,757	1,349	821
ESE					28		25	119	14,206	3,209
SE					20	19	6	48	117	10
SSE										
S										
SSW										
SW										
WSW										
W										1,099
WNW										
NW										
NNW										
Total				7	58	19	2,707	1,924	15,672	5,129

Population projections

A growth rate averaging about 3.1 percent is assumed most probable for Salt Lake County through the year 2005 because it corresponds to the growth rate of the county from 1970 to 1978. The development of synthetic fuels within the state, however, could create short-term rapid growth which should then taper off. If rapid developments in the energy field occur, the growth rate could go up to "7.0 percent declining," meaning in 25 years the growth rate will taper off to zero (FBDU, 1981).

It is projected that Tooele County will increase its population at an annual rate of 3.8 percent until 1985; thereafter, its growth rate will decline. This projection is based on expected energy development and subsequent employment opportunity that should also taper off. It is expected that the largest percentages of growth will occur in the City of Tooele, Grantsville, and Wendover (Mountain Area Planners, 1972).

4.12.2 Economic structures

Utah's most prominent employment sectors in 1979 were government with a 24 percent share of total wage and salary employment, services with a 16.4 percent share, retail trade at 17.0 percent, and manufacturing with 15.4 percent (U.S. Department of Commerce, 1981). Per capita income in 1979 was \$7182, which placed Utah below both the Rocky Mountain state and national averages.

County and local economic conditions

Salt Lake County, which is the State of Utah's central economic area, exhibits the same general economic health as the state as a whole. Its unemployment rate in 1980 averaged 5.1 percent, compared to a 5.4 percent statewide average (Utah Department of Employment Security, 1980). The County unemployment rate has been increasing since 1979. In 1982 it was 7.4 percent and in May 1983 it stood at 8.3 percent (seasonally adjusted). Based on the 2.5 employment multiplier used by the Utah State Planning Coordinator's Office for the Wasatch Front planning area, the basic-nonbasic employment multiplier for Salt Lake County is estimated at approximately 2.5 jobs supported by every job created in the basic, or export, sector of the economy. With regard to the temporary industrial park, it is estimated that each direct employee at the industrial park will generate an additional 1.6 jobs in the local economy (Division of Community Development, State of Utah, 1983 and State Planning Coordinator's Office, State of Utah, 1983).

Economic data reveal that the Tooele County economy is stable due to the intensiveness of Federal military employment but, like most rural areas in the state, it has a relatively high unemployment rate and underdeveloped secondary economy. Unemployment in Tooele County was 9.9 percent in 1982 (State of Utah, Job Service, 1983). Employment at the Deseret Test Center and Army Depot was primarily responsible for the Federal government employment share of 49.7 percent of the total 1979 wage and salary jobs in the County. Mining is the second most important sector of the export base of the County, providing 7.3 percent of the wage and salary jobs. The basic-to-nonbasic employment multiplier for Tooele County (assuming that all Federal and mining employment, 75 percent of all employment in the manufacturing sector, and 10 percent of all state and local government employment can be classified as basic) is estimated to be 1.5 jobs for every job created in the basic sectors.

Per capita income in Tooele County in 1979 was \$6782, 94.4 percent of the statewide average (U.S. Department of Commerce, 1981).

City of South Salt Lake

The economy of the City of South Salt Lake is based primarily in manufacturing, transportation, and wholesale and retail trade (Utah Department of Employment Security, 1980). The large industrial tax base in South Salt Lake permits the city to levy a relatively low city property tax (the 1982 mil levy was 6.25).

City of Tooele

The economy of the city of Tooele, the economic and population center of Tooele County, closely resembles that of Tooele County described above. The city's 1981 property tax rate was 25.16 mils.

4.12.3 Governmental structures

South Salt Lake, Tooele City, and Grantsville all have similar governmental structures, being governed by a mayor and five councilmen. Likewise, both Tooele and Salt Lake Counties are governed by three elected county commissioners who make certain decisions, such as those concerning zoning, and oversee the provision of services in their respective counties. For instance, Salt Lake County provides flood protection and health services to the City of South Salt Lake but delegates to the city the responsibility for maintenance of county roads located within the city. Special districts, though not governmental entities, are important in both counties, providing services such as sewage treatment and public education.

4.12.4 Housing

The total number of housing units in Tooele County increased from 6455 to 8566, an increase of 32.7 percent, between 1970 and 1980 (U.S. Department of Commerce, 1981). Housing unit growth was greatest, percentage-wise, in the Grantsville area, at 64.8 percent, but Grantsville's 1980 housing stock was still small at only 1348 units. The 1980 Census preliminary count indicated that 5 percent of all units in Grantsville were vacant. Tooele City's housing stock grew by 26.5 percent, to 4877 units. Preliminary 1980 vacancy rate data available from the Bureau of Census indicate that approximately 5.3 percent of the units are vacant. The county averaged 3.23 persons per dwelling unit in 1980.

4.12.5 Community services

Tooele County

Total enrollment in the Tooele County School District was 7011 students during the 1981-82 school year, 2.5 percent higher than during the 1979-80

school year (Tooele County Schools, 1981). It appears that enrollment will increase in the short-term future at about the same rate (1.2 percent per year) as in the recent past. In the short term, this rate of enrollment growth is not expected to cause physical-capacity or fiscal problems since the system is not experiencing significant overcrowding and has some excess bonding capacity.

Police protection is provided to the unincorporated areas in the County by a sheriff and 14 deputies (an average of 2.0 officers per 1000 population), and by a 20-member Jeep Patrol (Tooele County Chamber of Commerce, 1980). The County Sheriff also directs the County volunteer fire department which has 18 fire trucks at 9 fire substations located in Vernon, Clover, Terra, Ophir, Stockton, Pine Canyon, Lake Point, Stansbury Park, and Grantsville.

The County's single hospital, with 36 beds, is located in Tooele City and has a low average occupancy rate of 35 to 38 percent. Other medical services include two health clinics and one mental health clinic serving out-patients on a 24-hour basis. Ambulance service is provided for the County by a company in Tooele with one ambulance and three other vehicles (Tooele County Chamber of Commerce, 1980).

The County operates one public library housing 48,786 volumes, two book-mobiles and a storage facility in Grantsville that is open to the public (University of Utah Planning Program, 1981).

City of South Salt Lake

South Salt Lake is governed by a mayor and five councilmen. The city employs a part-time licensed engineer (Utah Industrial Development Division, 1981).

Education in the City of South Salt Lake and other nearby areas is provided by the Granite School District, one of four districts in Salt Lake County. Total District enrollment was 61,485 in September 1981, only about 2360 of whom were residents of South Salt Lake. The four schools that service the bulk of South Salt Lake, however, are expected to continue to have stable enrollments. No crowding problems exist or are expected in these schools.

The South Salt Lake Police Department employs 22 officers (2.0 officers per 1000 population) as well as a public relations specialist, lieutenant, and chief. It operates 17 vehicles and has 3 to 4 patrolmen on duty at any hour, providing an average response time of 2 to 3 minutes. The South Salt Lake Fire Department employs 16 men on a full-time basis and has 25 volunteers. Firefighting equipment includes two ladder trucks, two squad trucks, three pumper trucks and one utility/service truck. Response time is two to three minutes. The American Insurance Association rating for South Salt Lake is 5.

South Salt Lake utilizes a gravity water system from six wells. The system's storage capacity and peak pumping capacity (utilizing booster pumps) is 9 million gallons per day (mgd). The average pumping capacity is 5.5 mgd.

The sewage-treatment facility for South Salt Lake is a combination primary clarifier, trickling filter and anaerobic digester. The design average flow capacity is 3 mgd, current average flow is 2.4 mgd.

Located north of the Vitro site is the Salt Lake City Suburban Sanitary District No. 1 treatment plant (the CVWRF sewage-treatment plant of Figure 4-10). This system is bio-filter primary sedimentation type with a design average flow capacity of 17.25 mgd. The CVWRF Board is currently building a new facility on the site utilizing a portion of the existing plant; operation is planned for 1987. This plant will have a design average flow of 50 mgd and is expected to provide adequate treatment until the year 2000. Once completed, this system will replace the South Salt Lake and the Salt Lake City Suburban District No. 1 plants as well as the 7.5-mgd Granger-Hunter District plant, the 8-mgd Cottonwood District plant, and the 4-mgd Murray City plant.

4.12.6 Transportation networks

Existing vehicle entry to the Vitro site is from the south at 3300 South Street, which is also Utah State Highway 171. Highway 171 extends west through Granger, Hunter, and Magna where it intersects with Utah State Highway 111 (Figure 4-11). The annual average of daily traffic counts near the Vitro site on Highway 171 is 24,850.

It is expected that access to the Vitro site during the proposed remedial action would be via a new entry point on 900 West Street approximately 1200 feet north of 3300 South Street. All haul trips and miscellaneous delivery will be directed away from 3300 South Street. The expected haul route and its current average daily traffic volume are shown in Table 4-6.

The haul route between the Vitro and South Clive sites (truck option) would use 900 West Avenue, 2100 South Street (State Highway 201), and Interstate 80. Traffic volumes for 900 West Avenue and 2100 South Street to Interstate 80 are shown in Table 4-6 and Figure 4-11. At the intersection of State Highway 201 and Interstate 80 the annual average daily traffic volume is 15,515. This volume decreases to 4,560 vehicles per day north of Grantsville and to 3,465 vehicles per day at the South Clive site.

TABLE 4-6

Current and projected average daily
traffic (ADT) along the haul route

Roadway Section		1982 ^a ADT	Estimated 1986 ^b ADT
900 West Between	2100 S & 3300 S	9,300	10,265
2100 South Between	900 W & 1200 W	56,775	62,670
	1700 W & 3200 W	40,285	44,470
	3200 W & 3600 W	27,600	34,465
	3600 W & 5600 W	25,325	27,950

Table 4-6 (Continued)

Roadway Section		1982 ^a ADT	Estimated 1986 ^b ADT
5600 West Between	2100 S & 3500 S	10,725	11,840
	3500 S & 4100 S	8,350	9,215
	4100 S & 5400 S	7,225	7,975
5400 South Between	5600 S & West	4,200	4,635

^aUDOT 1984

^bAssuming a 2.5% per year increase in traffic

The Denver and Rio Grande Western Railroad forms the east boundary of the Vitro site. Any westward-bound rail shipments from the site would be transported north into Salt Lake City and then west along the Union Pacific line. Rail lines are also shown in Figure 4-11. Traffic counts for this railroad route are not available. However, railroad officials have indicated there would be no difficulty in accommodating the type and volume of traffic anticipated in Alternative 3.

4.12.7 Recreation

In Tooele County, the greatest number of recreational facilities available are for recreation with off-road vehicles, with open space, playgrounds, tennis courts, and softball fields next. The Wasatch National Forests provide a total of 936 sites for outdoor activities such as fishing, hiking, camping and picnicking, and hunting (Utah Travel Council, 1979). State Parks within Tooele County include the Great Salt Lake State Park Saltair Beach, located 15 miles west of Salt Lake City, the Bonneville Salt Flats, and Danger Cave located near Wendover. The salt flats are listed in the National Register of Historic Places and consist of approximately 44,000 acres of the remains of ancient Lake Bonneville that at one time covered nearly one-third of the state.

Recreational use of land within a 5-mile radius of Clive is limited to occasional recreational vehicle use and jackrabbit hunting. Off-road vehicle use near the site is rare due to the number of mud flats in the vicinity.

In Salt Lake County, facilities for softball, playgrounds, open space, soccer, tennis, and swimming are the most numerous with football, golf, and picnicking next. South Salt Lake has 3 parks for general picnic and recreation purposes, 1 ballfield, and borders a public golf course.

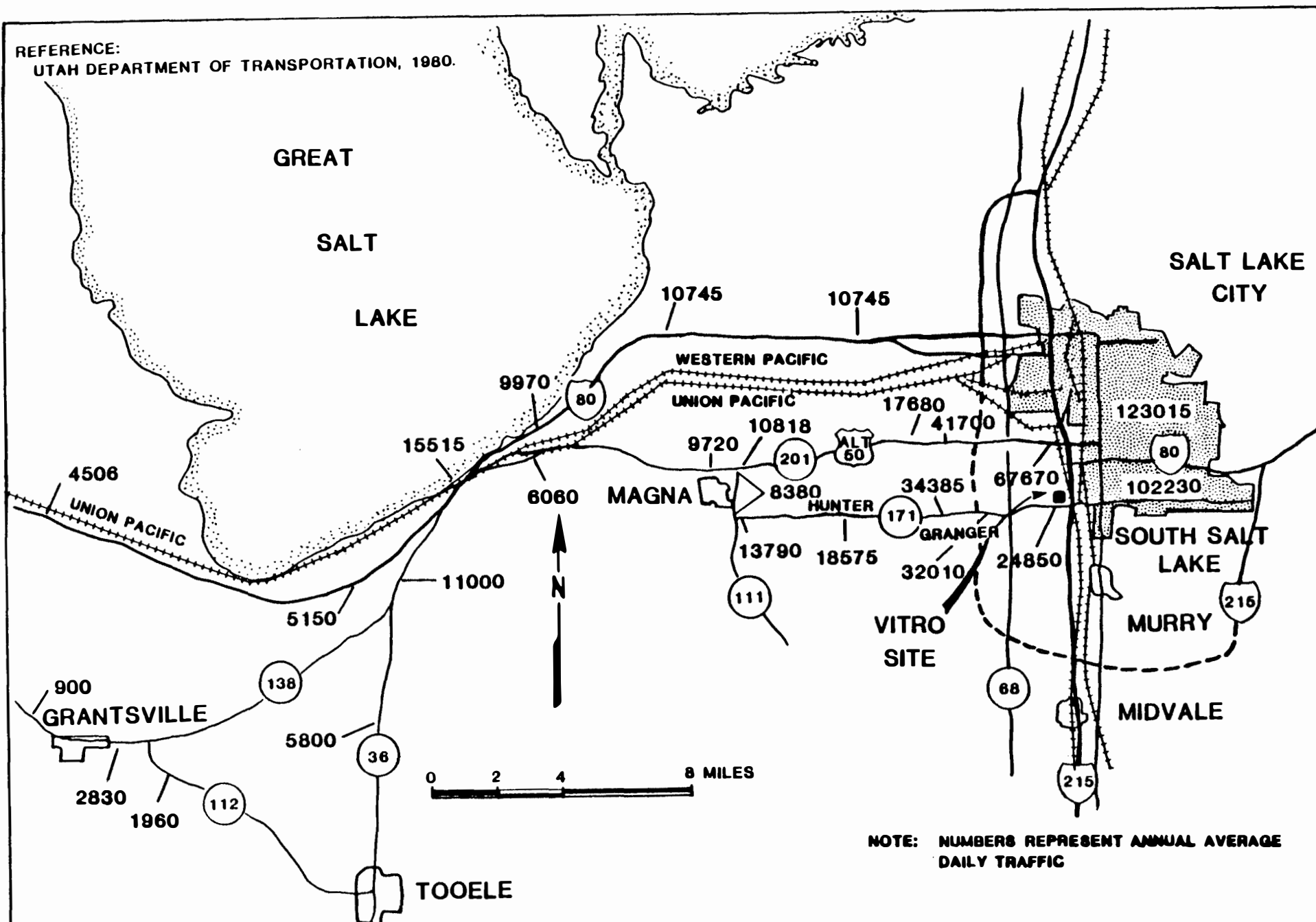


FIGURE 4-11. TRANSPORTATION ROUTES AND TRAFFIC VOLUMES

4.12.8 Public concerns regarding the remedial action project

Indications of public concern were received during the scoping meetings for this EIS, held in South Salt Lake City and Tooele City on May 5 and 6, respectively, 1981. The matters of concern mentioned most frequently during the public scoping meetings were the following ones.

- o What are the radiological effects upon physical health of the proposed actions? Tooele County speakers were concerned with long-term effects and the effects of transportation accidents.
- o What would be the indirect effects of the proposed actions on economic and social structures? Tooele County speakers mentioned the stigma that would be attached to their county should the Vitro wastes be placed there.
- o How would the proposed actions affect current land-use plans, policies, and controls? This concern was expressed exclusively by officials of South Salt Lake and Salt Lake County, who mentioned concern over economic losses caused by the presence of the Vitro tailings: loss of tax revenues, delays in completion of sewage-treatment facilities, and inhibition of development in a potentially prosperous industrial area.
- o What would be the effects of the proposed actions upon the quality of surface and near-surface waters? Concern was expressed that the Great Salt Lake would become contaminated.

These issues are addressed throughout the EIS.

Following the publication and distribution of the DEIS in February 1983, notice of its availability was published in the Federal Register on February 18, 1983 (48 FR 7294). The notice also announced the date for closing the comment period as April 4, 1983. Inserted in the DEIS was the notice of the public hearings to be held in Tooele on March 22 and in South Salt Lake on March 23, 1983. The DEIS was sent to more than 30 individuals, as well as to Federal and state agencies, elected officials, organizations, and public libraries. News releases were also disseminated announcing the dates and locations of the public hearings.

In preparation of the public hearings, a public meeting was announced and held on March 8 in Tooele and March 9, 1983, in South Salt Lake.

Comments received on the DEIS are summarized and answered in Chapter 6 of this FEIS; the DEIS has also been modified to reflect the comments received.

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5 ENVIRONMENTAL CONSEQUENCES

The environmental consequences of the three alternative remedial actions described in Section 3.2 and Appendix A are assessed in this chapter.

5.1 RADIOLOGICAL IMPACTS

5.1.1 Introduction

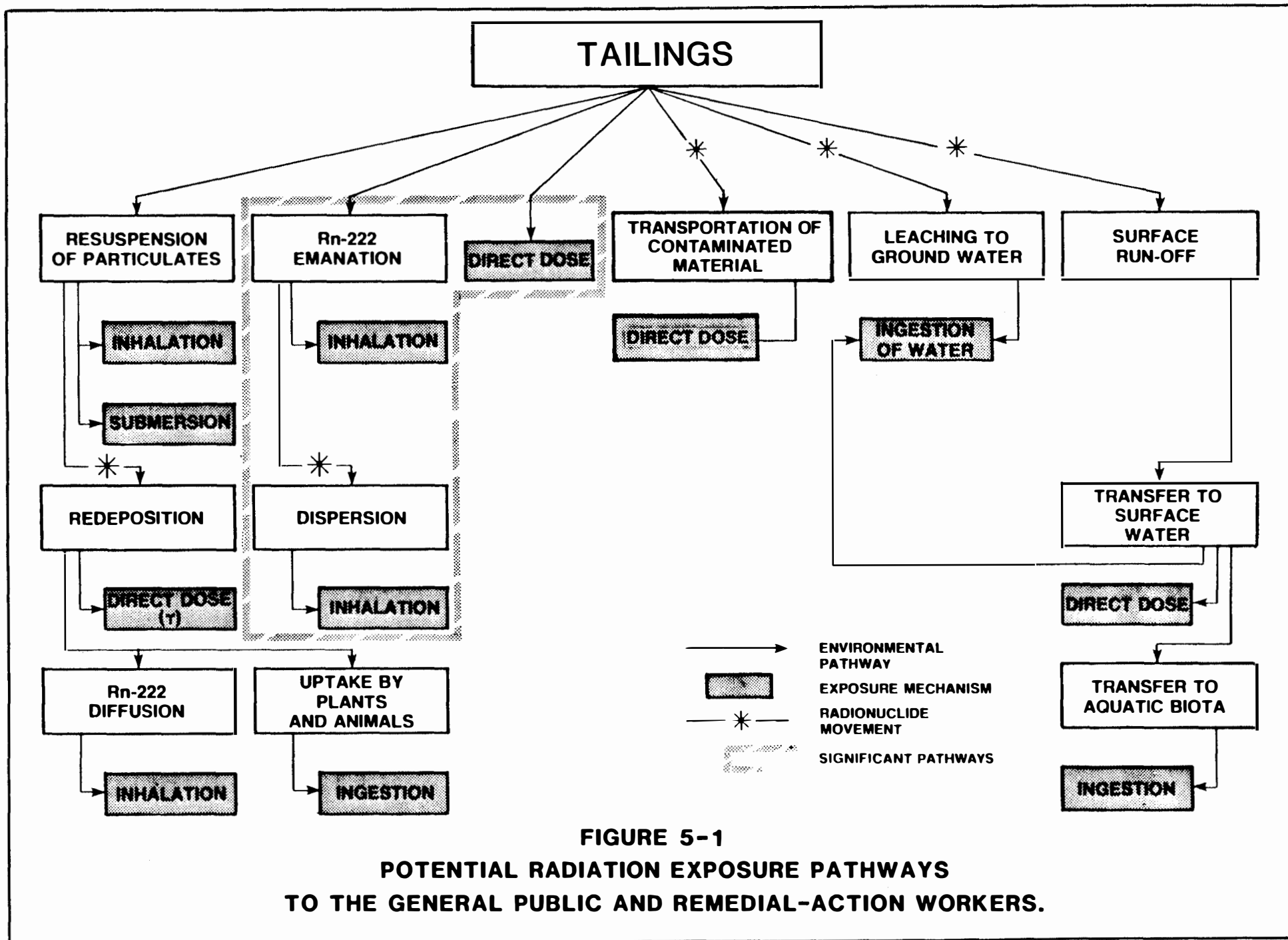
This section assesses the incremental radiological impacts resulting from each of the alternatives and indicates the methods used to perform the assessments. The data and information used to perform these impact assessments are detailed in Appendix F. Radiation doses and health effects for both the general population within 6 miles (10 km) of the Vitro site and the remedial action workers assigned to the Vitro and South Clive sites are included. Radiation doses and health effects are estimated for the transportation workers and the population along the transportation corridors for Alternative 3.

5.1.2 Exposure pathways

There are five principal environmental pathways by which individuals could be exposed to radioactivity during remedial action (Figure 5-1). These are (1) inhalation of radon and radon daughters, (2) exposure to direct gamma radiation from the tailings pile, (3) inhalation or ingestion of windblown radioactive particulates, (4) ingestion of ground or surface water contaminated by radioactive materials, and (5) ingestion of contaminated foods produced in areas contaminated by tailings.

For the calculation of health effects, only those pathways capable of producing the largest radiation exposures are considered. These are the first two above. Exposures via the latter three pathways are much smaller than the doses from radon daughter inhalation and direct gamma exposures. The inhalation of suspended particulates from the tailings pile results in relatively small radiation exposures for workers on the pile, and negligible exposures to the public (Appendix F, Section F.4). The ingestion of ground water is an insignificant pathway since there is no evidence that potable water drawn from deeper ground-water systems beneath the Vitro site have been contaminated (Section 4.6.2). The ingestion of surface water is an insignificant pathway since off-site surface waters near the Vitro site are not used for drinking purposes (Section 4.6.1). The ingestion of plant material that has been "dusted" with wind blown tailings, or the ingestion of animal food products (i.e., meat, milk, and eggs) from animals that have ingested such plant material is judged to be an insignificant pathway since the Vitro site lies downwind from the majority of the agricultural lands that are nearby.

The health effects from radon releases arise from inhaling radon daughters--the radionuclides resulting from the decay of radon. Radon is an inert gas produced from the radioactive decay of Ra-226. As a gas radon can diffuse through the tailings and into the atmosphere where it is transported



by wind over large areas. In the atmosphere, radon decays into its solid daughter radionuclides which attach to airborne dust particles and may be inhaled. These dust particles with the attached radon daughters may adhere to the lining of the respiratory tract--bronchia and lungs. The decay of the radon daughters releases radiation to the bronchial and lung tissue.

Gamma radiation is emitted by many radionuclides of the U-238 decay series. Gamma radiation is independent of atmospheric conditions and travels in a straight line until it interacts with matter, just as do x-rays. Gamma radiation emitted from the tailings delivers an exposure to the whole body. Gamma radiation becomes negligible due to interactions with air at about 1 km from the perimeter of the tailings.

Exposure to radon daughters and gamma radiation from the unstabilized tailings at the Vitro site currently impacts the general population and nearby workers. As remedial action is implemented, the exposures are anticipated to increase as the tailings are disturbed and transported. But as remedial action progresses and following its completion, the exposures will be greatly reduced due to the isolation of the radioactive materials from the environment. Each alternative includes the construction of a thick earthen cover which cannot be penetrated by gamma radiation from the tailings. The thick earthen cover will also serve as a barrier to the diffusion of radon from the tailings into the atmosphere. Although most of the radon will decay before escaping into the atmosphere, some will escape and may produce small exposures to surrounding populations. The radon release rate through the cover will be no greater than the allowable rate set by EPA standards (Section 3.1.1).

5.1.3 Methods of impact assessment

Radiation doses to the general population beyond 1 kilometer (km) from the site were evaluated using the computer code MILDOS (NRC, 1981). MILDOS provides estimates of the potential radiation doses to individuals in the vicinity of a typical uranium mill tailings disposal site. The input required by MILDOS includes (1) population distribution data, (2) meteorological data, and (3) radionuclide release data. The data used are discussed and presented in Appendices F and G.

The required radionuclide release data include (1) the radon emission rate from the pile surface, (2) radionuclide release rates for particulate emissions, and (3) the time periods over which the releases occur. Since the minimum time step in MILDOS is 2 years, some averaging of releases on shorter time scales is required.

The surface Rn-222 releases completely dominate the radionuclide emissions due to particulate sources (wind erosion and mechanical suspension of dust by earth moving equipment); thus the population and worker radiation exposures result primarily from radon releases (Section F.5, Appendix F). To illustrate the magnitude of the difference between exposures resulting from radon daughters and particulate inhalation, the latter is calculated for remedial action workers for Alternative 2 (Section F.4, Appendix F).

Since MILDOS does not calculate radiation exposures within 1 km of the site, these were estimated for remedial action workers, nearby workers, and the nearby general population using measurements of gamma radiation exposure rate and radon concentrations in air (Appendix F.5).

For Alternative 3, persons near the rail or truck transportation corridors may be exposed to gamma radiation from passing vehicles carrying radioactive materials from the Vitro site to the South Clive site. Although the time of exposure to such persons is small and radiation exposure from a vehicle low, the exposure from passing vehicles is calculated in Section F.5 of Appendix F. These calculations are based on average tailings radionuclide content, vehicle speed, and the exposure rate for a vehicle.

Estimates of cancer deaths in excess of those occurring normally in a population, as caused by radiation exposure, were made using the following risk factors (Section F.2, Appendix F):

- 20 lung cancer deaths in the exposed population for each 1,000,000 person-rem of dose equivalent commitment from inhalation of radon daughters (National Academy of Science, 1980; Evans et al., 1981).
- 120 cancer deaths in the exposed population for each 1,000,000 person-rem of dose equivalent from exposure to gamma radiation (National Academy of Science, 1980; Cohen, 1981).

A wide range of risk factors are accepted by experts who attempt to relate cancer deaths to radiation exposure. The ones given above are believed to be appropriate for the exposures from uranium mill tailings and to estimate realistically the cancer deaths associated with a given dose equivalent.

5.1.4 Radiological impacts

Estimates of the radiation dose equivalent commitments to the general population during remedial action under the three alternatives are presented in Table 5-1. The potential excess cancer deaths are given in Table 5-1, as well. These estimates were made using the methods outlined in Section 5.1.3 and detailed in Appendix F. The expected excess cancer deaths were obtained from the dose equivalent commitments by multiplying by the risk factors noted in Section 5.1.3. The doses and health effects to the general population are calculated for a 6-mile radius around the Vitro site. No person lives within 15 miles of the South Clive site, so only remedial action workers will be exposed there.

The maximally exposed individual would be one who resides about 300 feet from the southwestern corner of the Vitro site (Figure 1-1). That person could receive an annual gamma radiation dose equivalent of about 0.5 rem (EPA, 1980) in addition to about a 0.6-rem dose equivalent commitment from radon daughter exposure (Section F.5, Appendix F).

Table 5-1 Estimates of 3-year excess population dose equivalent commitments to the general public during remedial action, and expected excess cancer deaths caused by remedial action (based on a 3-year period for each alternative).

Organ	Population dose equivalent commitment									(person-rem)		
	(no action) Alt 1			Alt 2			Alt 3 (train)			Alt 3 (truck)		
	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c
Whole body	114	9.0	220	36	4.5	110	36	4.5	110	36	4.5	110
Bone	n.e. ^d	9.1	240	n.e.	4.6	120	n.e. ^d	4.6	120	n.e.	4.6	120
Lung	n.e.	9.0	220	n.e.	4.5	110	n.e.	4.5	110	n.e.	4.5	110
Bronchial epithelium	1,152	3,600	27,000	570	1,800	14,000	570	1,800	14,000	570	1,800	14,000
Expected excess deaths												
	(no action) Alt 1			Alt 2			Alt 3 (train)			Alt 3 (truck)		
	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c	1 km ^a	1-2 km ^b	1-10 km ^c
Cancer from whole-body gamma-ray exposure	0.014	0.0011	0.026	0.0043	0.0005	0.013	0.0043	0.0005	0.013	0.0043	0.0005	0.013
Lung cancer from doses to the bronchial epithelium	0.023	0.072	0.54	0.0114	0.036	0.28	0.0114	0.036	0.28	0.0114	0.036	0.28
Total	0.037	0.073	0.57	0.016	0.037	0.29	0.016	0.037	0.29	0.016	0.037	0.29

^aPopulation is 500 persons.

^bPopulation is 8,617 persons.

^cPopulation is 437,361 persons.

^dNot estimated.

Estimates of the radiation dose equivalent commitments to the remedial action workers for each alternative are presented in Table 5-2 along with the potential resulting excess cancer deaths.

The single most important pathway to the general population is the inhalation of radon daughters and the subsequent irradiation of the tracheobronchial system. For the remedial action workers, the more important pathway is gamma radiation exposure of the whole body. In order to put the estimated dose commitments in perspective, the estimated normal background radiation doses and EPA guidelines are presented in Table 5-3.

In the population of the U.S., about one person in six dies of cancer. This means that approximately 73,000 of the 438,000 persons who live within 6 miles of the Vitro site may be expected to die of cancer, regardless of the presence of the unstabilized tailings piles. The estimated increase in deaths due to Alternatives 2 or 3 would be about 0.4 person, an increase of 0.0005 percent. For remedial action workers the estimated increase is about 0.08 percent in Alternative 2, and about 0.20 to 0.30 percent in Alternative 3.

5.1.5 Radiological impacts of transportation accidents

Alternative 2 does not require off-site transportation of contaminated materials and it is hard to conceive of a transportation accident that would have radiological consequences involving persons other than remedial action workers. For remedial action workers the consequences of an on-site transportation accident would be largely nonradiological and would add nothing to their exposure. Nonradiological accidents are estimated in Section 5.12.

Alternative 3 involves the transport of 2.5 million cubic yards of contaminated material from the Vitro site to the South Clive site about 85 miles away. Both train and truck transport options could result in accidental spillage of material as a consequence of a transportation accident. Conceivably a loaded unit train could be derailed and overturned at some point on the route, spilling part or all of its 5400-ton load onto the railbed. Such an accident is not probable; based on estimates of the probability of its happening during the 634 train trips required, 0.05 spills reasonably could occur (Section F.3). The cleanup of the roadbed would be done promptly and the several-day exposure of the cleanup crew would be small compared to the 3-year exposure of remedial action workers at the Vitro and South Clive sites. Notification of the spill would be made to the appropriate authorities as required under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The truck option for transport to South Clive involves 97,800 truck trips over 3 years, and the probability for an accident leading to a tailings spill is somewhat greater than for train transport; about 7 spills reasonably could occur during the 3 years of remedial action. However, the radiological consequences are minimal considering the limited quantity of contaminated material involved and the short period of time that would be required for a cleanup (a day or less). Again, the exposures are small compared to that of the remedial-action workers at the Vitro and South Clive sites.

Table 5-2 Estimates of excess collective dose equivalent commitments to the remedial-action workers and expected excess cancer deaths caused by remedial action

	Population dose commitment (person-rem)							
	Alt 1	Alt 2	Alt 3 (train)			Alt 3 (truck)		
		Vitro	Vitro	Transport	South Clive	Vitro	Transport	South Clive
Whole body	0	65	163	4	109	179	68	103
Bronchial epithelium	0	480	420	0	320	380	0	220
Effect	Expected excess deaths							
	Alt 1	Alt 2	Alt 3 (train)			Alt 3 (truck)		
		Vitro	Vitro	Transport	South Clive	Vitro	Transport	South Clive
Cancer from whole-body gamma-ray exposure	0	0.0078	0.020	0.0005	0.013	0.021	0.008	0.012
Lung cancer from doses to the bronchial epithelium	0	0.0096	0.008	0	0.006	0.008	0	0.004
Total	0	0.017	0.028	0.0005	0.019	0.029	0.008	0.016

^aBased on worker hours of exposure in Tables A.4, A.7, and A.8.

Table 5-3. Background radiological levels and EPA limits

Parameter	Background dose per individual (mrem)	Background population dose (person-rem/yr)				
		General public ^a		Workers ^b		
		2 km	10 km	Alt 2	Alt 3a (train)	Alt 3b (truck)
Background external whole-body dose	105	905	46,000	25	23	22
Bronchial dose from ambient radon ^c	1,630	5,400	273,000	150	140	130
EPA indoor limit for whole-body gamma dose ^d	280	2,400	122,000	67	62	58
EPA indoor limit for bronchial dose ^e	5,400	47,000	2,400,000	1,300	1,200	1,100

^a8,617 people living within 2 km; 437,361 within 10 km.

^bBased on all workers in Tables A-4, A-7, and A-8 whether or not they receive occupational exposures. These total 240, 220, and 204 persons, respectively.

^cFrom background of 0.25 pCi/l of radon or 0.0025 WL.

^dFrom 20 μ R/hr + 12 μ R/hr background.

^eFrom the gamma limit plus the radon-daughter limit of 0.02 WL.

5.1.6 Comparison of radon-222 emissions with the EPA standards

As indicated in Section 3.1, the EPA has issued standards to be met in remedial actions such as those proposed in Alternatives 2 and 3. One of the standards is a limit on the radon flux from the surface of the stabilized disposal site. The limit is a flux of 20 picocuries per square meter per second (Table 3-1).

The average radon flux from the Vitro tailings pile is estimated to be 560 pCi/m²s (Section F-3). Formulae for calculating the amount of cover needed to reduce the radon flux from a source to a given level have been used to estimate the cover requirements for Alternatives 2 and 3 (Section A.4.6.1). The cover designs are intended to limit the radon flux to less than 20 pCi/m²s for both Alternatives 2 or 3.

Areas of the Vitro site that are decontaminated under Alternatives 2 or 3 would be backfilled with uncontaminated soil materials and will have radon fluxes in the range of natural radon fluxes.

5.2 IMPACTS ON AIR QUALITY

Alternative 1

The existing Vitro site has an unquantified fugitive emission from blowing dust. This is a variable emission because surface crusting, precipitation and wind velocity produce different effects at different times. The concentrations for total suspended particulates at this location were monitored and are referenced in Section 4.4 as indicators of what would continue with no action. The 1-year TSP monitoring program began in January 1982. The highest 24-hour concentration measured was 184 g/m³ which occurred on August 16, 1982. For comparison, the 24-hour primary and secondary National Ambient Air Quality Standards are 260 and 150 g/m³, respectively.

Alternative 2

The air quality impacts during stabilization at the Vitro site would be associated with the earthmoving activities and the equipment utilized in those activities. The diesel-fueled construction equipment used in earthmoving would produce exhaust emissions (based on AP-42; EPA, 1977) of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides and particulates that are estimated at 8.1, 2.5, 40.0, 3.1, and 2.0 tons per year, respectively. Ambient air concentrations from these emissions were estimated by scaling the modeling results for particulate emissions resulting in annual concentrations of approximately 20 micrograms per cubic meter (g/m³) for nitrogen oxides and less than 4 micrograms per cubic meter for the other parameters. Exhaust emissions would have little impact on the air quality off the site, and are probably exempt from air quality permit analyses under Part III of the Utah Air Conservation Regulations.

The greatest emissions will be fugitive dust related to the earthmoving activities. Unmitigated fugitive dust emissions are estimated to be 317.5

tons per year using algorithms currently acceptable to EPA, Region VIII and the Division of Environmental Health, Utah Department of Health (March 1982). Mitigation would reduce this emission load to approximately 258.3 tons per year. Fugitive dust emissions were estimated for material removed via bulldozer, scrapers, graders, and front-end loaders, and transport via scrapers, bulldozers, graders, and haul trucks. The assumptions used in the emissions calculations have included reasonably available control measures such as water spray, in accordance with the Utah Air Conservation Regulations and the 1982 Utah State Implementation Plan.

The impact on air quality was assessed with the atmospheric dispersion model, Industrial Source Complex (ISC) model. Hourly meteorological data from the Salt Lake City National Weather Service for 1980, and emission rates for each earthmoving activity were input to the model to calculate the maximum concentration to be expected under typical conditions. The results presented here were scaled from the modelling runs used for the DEIS. The highest annual average and 24-hour average concentrations off the site are predicted to be 42.5 and 415.5 g/m³, respectively. These concentrations would occur along the southern boundary of the Vitro site. The predicted fugitive dust impacts decrease rapidly with distance from their source because of particle deposition. The maximum particulate concentrations along the street south of the site are estimated to be 4.3 and 48.6 g/m³ for the annual and 24-hour averages, respectively.

The maximum predicted concentrations resulting from stabilization and the appropriate National Ambient Air Quality Standards (NAAQS) are shown in Table 5-4. The primary NAAQS were established to protect public health; the secondary NAAQS were established to protect public welfare. The predicted impact of stabilization at the Vitro site would be about 57 percent of the primary annual standard and about 160 percent of the primary 24-hour standard.

Table 5-4. Estimated fugitive dust concentrations and National Ambient Air Quality Standards

	Annual average concentration (g/m ³)	24-hour average concentration (g/m ³)
Maximum predicted Vitro offsite concentration	42.5	415.5
Primary NAAQS ^a	75 ^b	260
Secondary NAAQS ^a	60 ^b	150

^aUtah Ambient Air Quality Standards are the same as the National Ambient Air Quality Standards (NAAQS).

^bGeometric mean.

Alternative 3

The air quality impacts from either transportation option of Alternative 3 would be temporary and would result from site preparation, tailings removal, and site restoration operations at the Vitro site, the transportation of contaminated materials to the South Clive site, and site preparation and stabilization activities at the South Clive site. The vehicular emissions at the Vitro site and the South Clive site would be from heavy construction equipment performing earthmoving. The construction equipment at the Vitro site and the South Clive site and the haul trucks or trains needed to transport materials between these two sites would have emissions (based on AP-42; EPA, 1977) of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides and particulates that are estimated at 201.59, 33.59, 181.68, 21.81, and 11.02 tons per year, respectively, for the truck option, and 87.14, 51.71, 246.68, 30.35, and 15.70 tons per year, respectively, for the train option. The ambient air concentrations from these emissions were estimated by scaling the modeling results for particulate emissions resulting in annual concentrations of about 46 micrograms per cubic meter for nitrogen oxides and less than 5 micrograms per cubic meter for the other parameters at the Vitro site. The South Clive site would have annual predicted maximum concentrations of approximately 11 micrograms per cubic meter for nitrogen oxides and less than 2 cubic meters for the other parameters. Much of the air pollutants would be dispersed along the haul routes.

Fugitive dust emissions from earthmoving activities at both the Vitro site, the South Clive site, and along the haul routes are estimated to be 313.8 tons per year at the Vitro site, 235.3 tons per year at the South Clive site and 379.5 tons per year along the extent of the haul routes for the train option. The truck option would produce fugitive dust emissions of 448.1 tons per year at the Vitro site, 560.8 tons per year at the Clive site, and 1698.7 tons per year distributed along the haul routes. All of these estimates were produced using algorithms currently acceptable to EPA, Region VIII and the Division of Environmental Health, Utah Department of Health (March 1982). The impacts on the air quality at each of the sites were estimated separately with atmospheric dispersion models and input meteorology appropriate for each site. The Industrial Source Complex (ISC) model was used with 1980 Salt Lake City National Weather Service data to calculate the maximum concentrations expected at the Vitro site; the VALLEY model was used with Dugway Proving Ground meteorological data for 1957 to calculate the maximum concentrations expected at the South Clive site. In each case, emission estimates for each earthmoving activity were input to the appropriate dispersion models. Results presented below were scaled from DEIS model runs. Dispersion models were not used for prediction of impacts along the haul routes. The emission would be widely distributed and would not be expected to have significant impacts.

The maximum predicted annual and 24-hour off-site concentrations of particulate matter at the Vitro site are 43.8 and 313.1 g/m^3 , respectively, for the train option. Similar concentrations predicted for the truck option are 62.5 and 447.2 g/m^3 , respectively. These concentrations would be expected to occur along the southern boundary of the site. Because of

particle deposition, the train option concentrations would decrease to 3.3 and 36.6 g/m³, respectively, at 0.5 km from the southern site boundary. Similarly, the truck option concentrations would decrease to 4.7 and 52.3 g/m³, respectively, at 0.5 km from the southern site boundary. This distance is the location of the closest street to the site.

The maximum predicted annual and 24-hour concentrations of particulate matter off the site, due to the South Clive activities, are 48.5 and 241.3 g/m³, respectively for the train option. Similar concentrations predicted for the truck option are 115.9 and 574.7 g/m³, respectively. These concentrations would be expected to occur approximately 0.4 km north of the northern site boundary. The nearest human activity is about 6 km north of the site, the approximate location of the Interstate Highway 80. At 6 km, the annual and 24-hour particulate concentrations are predicted to be 1.4 and 16.1 g/m³, respectively, for the train option and 3.4 and 38.4 g/m³, respectively, for the truck option, based on the modeling results.

The estimated impacts of the fugitive emissions on the air quality with stabilization south of Clive are summarized in Table 5-5. The Utah and National Ambient Air Quality Standards are also presented for comparison. The maximum predicted impact at the Vitro site would be about 58 and 120 percent of the Federal primary annual and 24-hour standards, respectively, for the train option, and 83 and 172 percent of the same standards, respectively, for the truck option. The maximum predicted impact at the South Clive site would be about 65 and 92 percent of the Federal primary annual and 24-hour standards, respectively, for the train option, and 154 and 221 percent of the same standards, respectively, for the truck option.

Table 5-5. Fugitive dust impacts, Alternative 3

	Train option	Truck option
Average annual TSP (tons/yr)		
Total	928.8	2720.1
Vitro site	313.8	448.1
Clive site	235.3	560.8
Haul routes	379.5	1698.7
Annual concentration (g/m ³)		
Vitro site	43.8	62.5
Clive site	48.5	115.9
24-hour concentrations (g/m ³)		
Vitro site	313.1	447.2
Clive site	241.3	574.7

Table 5-5. (continued)

		<u>Train</u> <u>option</u>	<u>Truck</u> <u>option</u>
Primary NAAQS ^a	Annual ^b /24-hr	75 ^b /260	
Secondary NAAQS ^a	Annual ^b /24-hr	60 ^b /150	

^aUtah Ambient Air Quality Standards are the same as the National Ambient Air Quality Standards (NAAQS).

^bGeometric mean.

5.3 IMPACTS ON TOPOGRAPHY, SOILS, AND MINERAL RESOURCES

5.3.1 Impact on topography

The no-action alternative would not alter the topography of either the Vitro site or the South Clive site.

Alternative 2 would affect only the Vitro site. A flat-topped mound, 50 feet high, with sideslopes of 1 vertical to 5 horizontal, would be formed on a 53-acre area occupying the southcentral and southeast portion of the site. The remainder of the tract would be recontoured to the natural elevation of the surrounding terrain (approximately 4235 feet above mean sea level) and revegetated.

Alternative 3 would affect both the Vitro site and the South Clive site. At the Vitro site, the entire 128-acre tract now containing the tailings would be recontoured to the natural elevation of the surrounding terrain. At the South Clive site, approximately 55 acres of the presently flat terrain would be occupied by a flat-topped mound, approximately 34 feet high, with sideslopes of 1 vertical to 5 horizontal.

5.3.2 Impacts on soils

No soils would be affected by the no-action alternative. In both Alternatives 2 and 3, however, soils imported from commercial sources would be used for either backfill, liner, and/or cover at the Vitro site. The estimated amounts of materials to be imported are given in Table 5-6.

Table 5-6. Materials that must be imported to Vitro site

Work or material	Quantity (cubic yds)	
	Alternative 2	Alternative 3
Seepage control lining		
(a) Subbase	220,000	---
(b) Base	300,000	---
(c) Liner	190,000	---
Restoration grading	710,000	1,040,000
Cover-radon and erosion barriers	445,000	---
Total	1,865,000	1,040,000

In Alternative 3, soils removed from the South Clive excavation would be reused in the construction of the reclamation cover. In addition, about 244,000 cubic yards of gravel or quarried bedrock would be needed for the erosion barrier, access roads, and drainage ditches at the South Clive disposal area; this material is available in the Cedar Mountains to the east of the site, and could probably be obtained from commercial sources.

5.3.3 Impacts on mineral resources

The no-action alternative would not affect mineral resources. Neither Alternative 2 nor 3 would affect the negligible mineral resources of the South Clive site (see Section 4.5.3). However, both of the action alternatives would result in the setting apart, under the control of the Federal government, the residual mineral values of the uranium mill tailings presently on the Vitro site. The potential mineral products that would be lost at either the Vitro site (Alternative 2) or the South Clive site (Alternative 3) are estimated below (DOE, 1982).

<u>Product</u>	<u>Total lbs</u>
U ₃ O ₈	659,452
V ₂ O ₅	4,198,565
Mo	762,458

5.3.4 Longevity of conceptual designs against wind erosion, water erosion, and earthquakes

In addition to radon flux standards, the EPA standards also have a longevity requirement: that there be a reasonable expectation that the disposal configurations adopted for the remedial action meet the standards for up to 1000 years, to the extent reasonably achievable, and in any case for at least 200 years. The assessment of the longevity of the disposal configurations used in Alternatives 2 and 3 are discussed in the following subsections.

Alternative 2

The disposal configuration in Alternative 2 would include a 4- to 5-foot cover composed as follows: 1 foot (2 feet on the side slopes) of pit run rock, underlain by 3 feet of silty soils. The presence of the pit run rock layer would protect the stabilized pile indefinitely against wind and water erosion.

The disposal configuration at the Vitro site would also be subject to the long-term effects of flooding and earthquakes. One possible design criterion for flood protection is the Probable Maximum Flood (NRC, 1977). Design criteria for long-term protection against earthquakes that pertain to earthwork structures such as these are discussed in terms of allowable safety factors in Section A.3.2.2 of Appendix A, and Appendix H.

In Appendix A, Section A.3.2.2, it is shown that the Probable Maximum Flood (PMF) of the Jordan River would inundate the Vitro site area to depths of up to 10 feet. During the passage of the PMF peak, a duration of about 40 hours, water velocities near the embankment would be between 4 and 5 feet per second. Six-inch mean diameter pit run rock on the pile side slopes could withstand flood velocities of 14 feet per second. The Vitro site disposal configuration would, therefore, not be damaged by the PMF.

A seismic evaluation of the embankment at the Vitro site has been performed (SH&B, 1983; and Appendix H). Seismically induced liquefaction of the subsurface sandy materials could occur in the event of a Maximum Credible Earthquake (MCE). However, during construction the embankment materials will be dewatered, mixed, and recompacted and thus will not be susceptible to liquefaction. Minor cracking (a few inches) of the cover could occur if the foundation soils liquify. Minor cracking could also result from earthquake-induced ground motions of lesser intensity, occurring every 50 to 400 years. Cracking of the cover would only require minor repair.

Alternative 3

The disposal configuration at the South Clive site in Alternative 3 includes a cover that would be composed of a 5-foot layer of compacted natural soils protected by a 2-foot surficial layer of pit run rock. The presence of the coarse granular layer would protect the stabilized pile indefinitely against wind and water erosion.

The disposal configuration at the South Clive site would also be subject to the long-term effects of flooding and earthquakes. One possible design criterion for flood protection is the Probable Maximum Flood (NRC, 1977). Design criteria for long-term protection against earthquakes that pertain to earthwork structures such as these are discussed in terms of allowable safety factors in Section A.6.2.2 of Appendix A, and Appendix H.

The Probable Maximum Flood (PMF) that would impact the South Clive site would be the result of a 6-hour, 9.7-inch rainfall (PMP) on the 46-square-mile

drainage area east of the site. It would have a peak flow of about 83,000 cfs and reach depths of up to 5.5 feet deep in the ditch surrounding the embankment. The correlating velocities are 2.0 fps with a peak of 10 fps at the embankment toe. The 5-inch mean diameter pit run rock covering the side slopes can withstand these velocities. Thus, the South Clive embankment would not be damaged by the PMF.

The seismic evaluation performed for the South Clive site (Appendix H) indicates that the chance of seismically induced liquefaction in the site subsoils is remote. First, the ground water is about 20-30 feet below the surface and is below several layers of unsaturated silty sand. Second, these sand layers are of medium to high densities. These factors, combined with the relatively large static overburden pressures applied to the saturated soils layers, indicate that significant liquefaction due to an MCE event is improbable and only minor cracking would occur. Most of these cracks would be self-healing and result in only minor cover repairs.

5.4 IMPACTS ON WATER

5.4.1 Impacts on surface waters

The no-action alternative would have no effect on present quantities or uses of the surface-water systems associated with the Vitro site or the transportation corridor. There are no perennial surface-water systems associated with the South Clive site.

Under the no-action alternative, surface runoff from the Vitro site might reach the two on-site ditches (the Vitro Waste Ditch and the South Vitro Ditch) and cause temporary water-quality degradation. The topography of the existing site is such that surface runoff does not reach these ditches except in heavy rains. The effects of a PMF at the unstabilized Vitro site on the quality of local surface waters are unknown; but the radiological effects would be miniscule in comparison with other effects of the flood such as damage of property and loss of life.

Under either Alternatives 2 or 3, waste waters generated by dewatering activities at the Vitro site would either be discharged to Mill Creek (after treatment) if radiological and chemical analyses indicate they meet the discharge-permit standards, or they would be stored in temporary evaporation ponds on the site. Both procedures would operate under National Pollutant Discharge Elimination System (NPDES) permits. Further water-quality protection would be provided by the installation of dikes around evaporation ponds and wet areas being excavated.

Neither Alternatives 2 or 3 would have any effect on surface-water quantities at either the South Clive site or the Vitro site. At either site, the water necessary for construction would be provided by on-site wells or existing wells in the vicinity, impounded water, or from the South Salt Lake community system. Alternative 2 would have long-term beneficial impacts on surface-water conditions at the Vitro site. The stabilized mound with its cover would inhibit rain from percolating into the tailings. Improved site

drainage would also reduce sediment and contaminant loading to the Vitro ditches. Alternative 3 would eliminate the possibility for future contamination of surface water at the Vitro site.

Neither Alternative 2 nor Alternative 3 would have any predictable effects on the quantity or quality of surface waters along the transportation corridors. Some contamination of the Great Salt Lake would be possible if a transportation accident occurred in which one of the unit trains or trucks were overturned at a point where the railroad bed/I-80 is adjacent to the lake, but such an accident would be highly improbable (see Section 5.1.5).

The waste waters generated by construction activities at the Vitro site in Alternative 3 would be handled in the same way as Alternative 2. The amount of waste water to be handled would be larger in Alternative 3 because of the need to wash down the unit trains or trucks that leave the construction site. The amount of dewatering would be minimized, as much as practicable, by construction practices and schedules; it is estimated that 150 gallons per minute of discharge from dewatering may have to be handled for brief periods of time. Train wash-down would require about 2,000 gallons of water each working day, this wash-down water would be obtained from on-site wells. However, because this water would be recycled only 600 gallons per day would be required for make-up. Truck wash-down would require several times as much water; about 2,300 gallons per day would be required for make-up.

Dewatering requirements at the South Clive site in Alternative 3 would be minimal because the bottom of the excavation would be at least 15 feet above the ground-water table. Train or truck wash-down water requirements at the South Clive site would be the same as those for the Vitro site in Alternative 3.

5.4.2 Impacts on ground waters

Alternative 1

The no-action alternative would have no effect on ground-water systems along the transportation corridors or at the South Clive site.

Under the no-action alternative, the potential for degradation of ground-water quality at depth beneath the Vitro site would continue to exist. This potential is, however, limited due to the hydrogeologic setting. As discussed in Section 4.6.2, the Vitro site is located within an area of regional ground-water discharge. The upward gradient and migration of ground water precludes the downward migration of leachate and associated contaminants from the uranium mill tailings. The upward gradient and direction of ground-water flow could be reversed, however, as a result of increased pumping and ground-water withdrawals in the vicinity of the Vitro site.

In the no-action alternative there would also be a potential for lateral migration of leachate and associated contaminants within the shallow ground-water system beneath the site. Data for the Vitro site indicate that the ground water within the shallow system directly beneath the site is contaminated. Because of the low gradients, low hydraulic conductivity, and

sorption of contaminants on soil particles, the rates of lateral contaminant migration within the upper flow system would be very small, that is, only a few feet per year.

Alternative 2

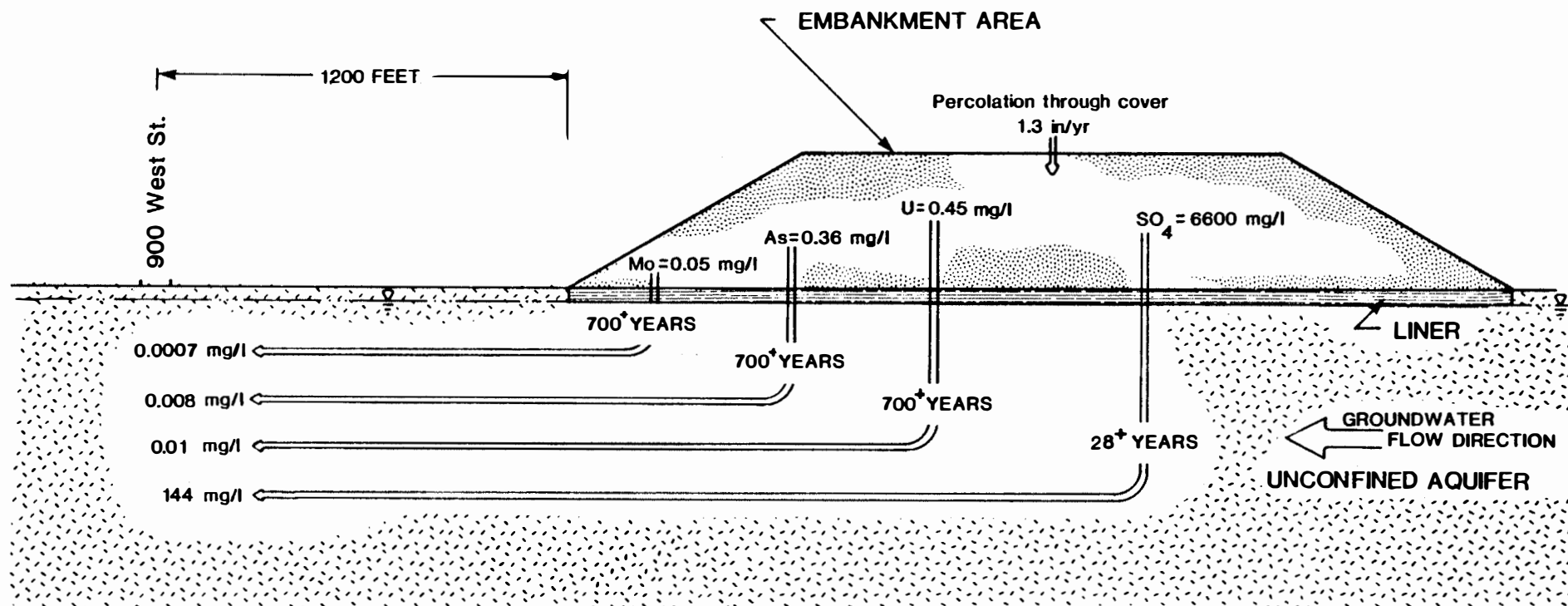
Under Alternative 2, there would be a limited potential for the degradation of water quality in the confined aquifer system in the vicinity of the Vitro site. At present, the vertical hydraulic gradient in the area is upward from the confined system to the unconfined system, effectively precluding the downward migration of contaminants. The vertical hydraulic gradient can be reversed by heavy pumping in the vicinity of the Vitro site, as evidenced by relic contamination of the confined aquifer probably associated with pumping of process water at the former Vitro mill site, or other heavy pumping of the confined system in the area. This potential contamination would not include the migration of radionuclides and trace metals, which are effectively sorbed in the unconfined system. The lack of minor and trace constituents and radionuclides in the contaminated samples from the confined aquifer suggests that the potential contamination would be limited to high concentrations of total dissolved solids, sulfate, chloride, and other major ions, and would be due in part to the poor background water quality in the unconfined system.

The remedial action would decrease potential trace metal contamination of the ground water to insignificant concentrations. Based upon a worst-case analysis, transport of uranium, molybdenum, and arsenic from the base of the encapsulated tailings to the water table would require a minimum of 700 years. A probable-case analysis resulted in a delay time of 7700 years for these parameters to reach the water table. Once the contaminants entered the unconfined aquifer, downgradient concentrations would be insignificant. Concentrations of uranium, molybdenum, and arsenic are predicted to be 0.01, 0.001, and 0.008 mg/l, respectively, at 900 West Street (Figure 5-2) (see Appendix D).

Alternative 3

Under Alternative 3 there would be a minimal potential for degradation of water quality in the vicinity of the South Clive site. The ground water at the site is already characterized by a briny quality, with levels of many constituents (major ions, metals, total dissolved solids, uranium) exceeding EPA primary or secondary drinking water standards, often by a large amount. The water might be suitable only for some industrial uses without extensive treatment. There are no identified uses of ground water in the near vicinity (3 miles) of the South Clive site. Alternative 3 would also have the beneficial effect of eliminating any possibility of future contamination of ground water at the Vitro site.

The design will minimize the potential for transport of contaminants away from the tailings. The cover will reduce the potential for infiltration, which is already believed to be minimal in the area due to the low incident precipitation and high potential evapotranspiration. Some seepage would be expected to reach the ground water as a result of moisture redistribution



NOTE: ALL CONCENTRATIONS
ARE ABOVE BACKGROUND

FIGURE 5-2
TRACE METAL CONCENTRATIONS
AFTER REMEDIAL-ACTION

within the tailings. The impact of this seepage on the ground water is expected to be minimal for several reasons:

- The volume of seepage would be expected to be small, and would occur over a long period of time.
- The existing poor quality of the ground water makes it difficult to significantly degrade it.
- The hydraulic head gradient in the ground water is small, limiting the velocity of ground-water movement away from the site to a maximum of 0.6 feet per year.
- In 1000 years the ground water flowing away from the site would move only a fraction (3/100) of the distance to the closest identified well.

Under Alternatives 2 and 3, a relic contaminant plume would persist in the unconfined aquifer downgradient of the Vitro site Appendix D.3.2. This plume would consist of elevated concentrations of total dissolved solids (TDS), sulfate and other major ions, and uranium. The plume would move toward the Jordan River at a velocity of 0.3 to 1.6 feet per day, so that the tail of the plume would reach the river in about 4 to 24 years. Initial concentrations of contaminants would be the same as currently found, decreasing slightly over time, as mixing would take place in the unconfined system. The plume would be greatly diluted as it neared the river, eventually discharging into the river at levels representing only a minor addition to background concentrations.

Aquifer restoration of the relic plume was assessed (see Section D.3.6 for details). Given the boundary conditions and ground-water quality of the unconfined aquifer, the maximum possible volume of contaminated ground water was considered. The cost-benefit calculations were bounded by:

- The treatment rate and required treatment time (3 years at 1000 gpm and 6 years at 500 gpm).
- The time required for the contaminant plume to dissipate naturally (4.4 years to 23.7 years).
- The method of assessing net benefit (net benefit calculated by volume of contaminated and potentially contaminated ground water and net benefit calculated by spatial apportionment).

By using the three sets of bounds, a matrix of eight cost-benefit ratios was calculated. These ratios ranged from 4.1 to infinity. Aquifer restoration does not seem warranted given the high cost-benefit ratios and the absence of ground-water use in the maximum area of the contaminant plume.

Although the likelihood of human health impacts from uncontrolled use of the unconfined aquifer downgradient of the Vitro site is considered very small, DOE will review with NRC and the State of Utah the desirability of mitigation measures to limit the use of this ground water.

5.5 IMPACTS ON ECOSYSTEMS

This section describes the impacts of the three alternatives on vegetation and wildlife. Impacts on soils are described in Section 5.3.2.

The no-action alternative would not affect existing vegetation and wildlife at the Vitro site, the South Clive site, or along the transportation corridors.

Alternative 2 would not affect existing vegetation and wildlife at the South Clive site or along the transportation corridors. At the Vitro site, implementation of Alternative 2 would result in the destruction of existing vegetation and marginal wildlife habitat on the 128-acre site. Since the biological productivity of these disturbed and developed areas is so low, such a loss would not be appreciable. No endangered, threatened, or rare species would be affected by Alternative 2.

At the Vitro site, implementation of Alternative 3 would also result in the loss of vegetation, wildlife, and marginal wildlife habitat that exists on the entire 128-acre site; because present productivity is low, this loss would not be appreciable. Long-term changes in vegetation and wildlife habitat would depend upon the uses made of the 128-acre, decontaminated site by the CVWRF Board; consideration of these changes is not within the scope of this EIS.

At the South Clive site, up to 200 acres of the existing plant community (shadscale-gray molly) and its attendant habitat for wildlife would be destroyed or disturbed. This type of plant community is neither unique nor particularly valuable in any way. None of the flora or fauna in the potentially disturbed area are endangered or threatened. Displacement of individuals during construction at both the South Clive site and the Vitro site could result in a temporary increase in the populations and stress of individuals in the areas surrounding both sites. Road kills of animals near the South Clive site and along the transportation corridors would be minimal. Otherwise, Alternative 3 would not have any predictable effect on existing vegetation and wildlife in or near the transportation corridors.

5.6 IMPACTS ON LAND USE

The impacts on land use that would be associated with the three alternatives under consideration would be both short-term and long-term.

Alternative 1

With the no-action alternative, lands on the Vitro site are expected to continue to be developed by the CVWRF Board according to their short-range plans (Section 4.9 1); the impacts of a no-action alternative on the long-range plans of the CVWRF Board are not predictable. Lands in the site's vicinity would probably continue to be developed for warehousing and industrial purposes. As evidenced by the gradual lifting of the building moratorium imposed during the early 1970s for the area near the site, fears that severe health hazards to workers in the area may be posed by the tailings have partially subsided.

The no-action alternative would not affect land use at the South Clive site or along any transportation corridor.

Alternative 2

Alternative 2 would not affect land use at the South Clive site or along the adjacent transportation corridor; however, as explained below, planned long-term use of the 128-acre Vitro site might be partly constrained by Alternative 2.

Under Alternative 2, some types of land uses may be feasible on portions of the site once stabilization is complete. These uses may include some expansion of the CVWRF sewage-treatment plant now operating in the northcentral portion of the site and industrial and warehouse facilities; however, construction of warehouses, commercial, or industrial facilities, which are common to the area, might not be feasible if there are restrictions on the placement of building foundations near the stabilized mound.

The 53-acre tailings stabilization area (Figure 3-3) would not be suitable for any other use, including the planned expansion of the CVWRF sewage-treatment plant. The area along 3300 South Street that is planned for industrial, commercial, or warehouse lease under the alternative of stabilization south of Clive may not be useable. The northern portion of the Vitro site would be available for expansion of the CVWRF plant, although expansion as currently planned would not be feasible. About 20 acres in the southwest portion of the Vitro site would be available for development. Development in this area could include expansion of the CVWRF plant, leasing for industrial, commercial, or warehouse uses, construction of the waste-recycling facility proposed by the Wasatch Front Regional Council of Governments, construction of the planned municipal ground-water facility, or other uses, depending upon foundation restrictions that may apply.

The long-term impacts of Alternative 2 on CVWRF expansion are not predictable; they would depend upon the CVWRF Board's response to the need for major changes in plans. The short-term impacts on the CVWRF of Alternative 2, the impacts to be realized over the next 5 to 10 years, would occur mainly in the form of lost income from forgone leases on properties in the southern part of the site (the "lease-only" properties shown in Figure 4-7). This loss of potential income is estimated to be \$7,840 per year per acre leased. (Appendix I).

It is anticipated that stabilization at the Vitro site would not affect future land uses in the vicinity. The surrounding area is no longer under the building moratorium imposed during the 1970s and development of its vacant lands, primarily for warehouse and wholesaling uses, has resumed. Most vacant and agricultural lands in the vicinity are planned for warehouse, industrial, and commercial uses, the proximity to major rail and road transport routes being ideal for these uses. It is possible that stabilization would encourage more rapid development in the area than would the no-action alternative; companies may be less willing to move to the area if unstabilized tailings continue to be located there.

Alternative 3

Decontamination of the Vitro site and the transport of the tailings from that site to the South Clive site would result in land use impacts at both sites and along the transportation corridors linking them. These impacts would consist of the following:

1. Permanent preemption of about 60 acres of land at the South Clive site for the stabilization area and ancillary facilities. The current uses of the area (sheep grazing and possibly some recreational vehicle and jackrabbit hunting activity) would not be possible within the area preempted by the disposal site.
2. Opening of the entire 128-acre Vitro site for development.
3. Establishing incentives for more rapid warehouse, wholesaling, and industrial development in the vicinity of the Vitro site.

During the 3-year construction phase of Alternative 3, approximately 200 acres of land on the South Clive site, and along the bed of the railroad spur or truck access road leading into it from Clive, would be preempted from current uses. Sheep grazing, hunting, or recreational-vehicle driving would be temporarily prohibited on the lands affected by the construction operations. Following completion of the 3-year construction phase, about 60 acres (55 acres for embankment, 5 for ancillary facilities) of land at the South Clive site would be permanently removed from use by the public, or by the State of Utah as a source of revenue from leases. The loss of lease revenue to the State is estimated to be between \$25 and \$150 per year per section leased.

Decontamination of the entire 128-acre Vitro site would permit the site to be used for virtually any purpose. The owners of the site, the CVWRF Board, may use most of the site for expansion of the waste-water treatment plant and the area along 3300 South Street may be developed for wholesaling, warehousing, or industrial purposes.

5.7 IMPACTS ON SOUND LEVELS

Alternative 1

The no-action Alternative would not affect ambient sound levels that prevail at the Vitro site, the South Clive site, or in the transportation corridor that connects the two sites.

Alternative 2

In Alternative 2, the major noise impact would be due to the excavation and consolidation of the contaminated material to the 53-acre embankment area, and the preparation, grading, and restoration of the embankment area. The embankment area is in the southeast corner of the Vitro site and is in close proximity to the populated areas to the west and south.

A noise-prediction model (Kessler et al., 1978) was used that considers the number of and maximum noise level from each piece of equipment used at the site, the percentage of time this equipment operates in its noisiest mode, and the distance from the center of site activity to nearby noise-sensitive areas. The noise-level extrapolation model is conservative (i.e., its results are higher than would be realized) as no attenuation for air absorption, berms, or foliage are considered in the model.

For these calculations, all equipment was assumed to be located at the center of the embankment area. This assumption would also cause the computation to overstate the resulting noise levels. Table 5-7 lists the emission and use factors used in these calculations. Equipment use, by phase, is shown in Appendix A, Section A.9.

The distances from the center of the site to noise-sensitive areas to the south and west are 1,060 and 1,700 feet, respectively. These distances have been scaled from FBDU, 1981, Figures 2-1 and 4-1.

Table 5-7. Equipment noise emissions and use factors

Equipment	Use factor	Emission factor (dB @ 50 ft)
D-8 dozer	0.5	88
Front-end loader (cat. 988)	0.5	88
Scraper	0.6	91
Backhoe	0.2	77
Water truck	0.5	89
Haul truck	0.5	86
Compactor	0.1	82
Grader	0.4	88

Source: Kessler et al., 1978

The estimated ambient sound levels during the remedial action are shown in Table 5-8. The background ambient sound levels shown in the table are only approximate, having been estimated and not measured. Section 4.10 discusses the method used to make these estimates.

Table 5-8. Estimated operation ambient sound levels

Residences	Background ambient sound levels L _{dn} (dB)	Operation ambient sound levels L _{dn} (dB)	Change in L _{dn} (dB)
Along 3300 So. St.	65	73	8
To the west	60	69	9

Ambient sound levels would change by about 8 dB at the residences to the south and by about 9 dB at the residences to the west. The residents of the homes to the west may experience some noise impact during the period of operation. The noise impact for the residents to the south would be minimal. During operation, day-night sound level (L_{dn}) values would approach the EPA's short-term goals of $L_{dn} = 70$ dB, but since this area is zoned industrial the operation should be in compliance with South Salt Lake's noise ordinance limits of 80 dB during daytime. Construction noise would be minimized during the night.

Alternative 3

Noise emissions projections were estimated using the methodology described under Alternative 2. The inputs for the model were obtained from Appendix A, Section A.9. The results of the noise modelling effort are presented in Table 5-9. This table displays the expected noise emission for each phase of the remedial action, and for each of the two optional transportation methods at the Vitro and South Clive sites. Emission rates 500 feet from the center of the Vitro site range from 76.2 dB to 72.5 dB depending upon the remedial-action phase and transportation option. Emission rates 500 feet from the center of the South Clive site range from 78.3 dB to 73.8 dB depending on the remedial-action phase and transportation option.

Table 5-9. Alternative 3 noise emission projections
(dB @ 500 feet)

Construction phase	Vitro site		South Clive site	
	(train option)	(truck option)	(train option)	(truck option)
Site preparation	75.9	72.5	76.1	74.7
Tailings relocation	76.2	75.0	na	na
Embankment construction	na	na	78.3	73.8
Site restoration	74.1	74.1	na	na

na = not applicable

The estimated operational day-night sound level (L_{dn}) at homes to the south and west of the Vitro site are 69.8 dB and 65.4 dB, respectively. This would result in an L_{dn} change of 5 dB, at each residential area. Thus, the noise impact on residents living in the homes near the Vitro site for this alternative would approximately be the same as the impact of Alternative 2. Day-night sound levels would approach the U.S. EPA's short-term goals of $L_{dn} = 70$ dB during operation, but since this is an industrial zone, South Salt Lake's noise-ordinance limits of 80 dB for daytime activity should be met. Construction noise would be minimized during the night.

Railroad operations or highway operations will not significantly add to present rail or highway traffic noise. Very little change in ambient day-night sound levels will result. If, for example, the railroad and highway traffic doubles (a very remote possibility), the ambient sound can expect to increase by about 3 dB. This change will not be significant. In addition, very few people reside along this route. Thus, little noise impact is anticipated.

The noise emissions projections for the South Clive site are also shown in Table 5-9. No noise impacts would be expected from the remedial action since very few people reside in the area of the proposed site and there are no noise-sensitive land uses within 15 miles of the site. Noise attenuation would be expected to reduce the maximum South Clive emission to below the background level of 35 dB within 7000 feet of the source.

5.8 IMPACTS ON SCENIC, HISTORICAL, AND CULTURAL RESOURCES

The impacts of the alternatives on scenic, historical, and cultural resources are not expected to be significant.

There are no historical or cultural resources of significance at either the Vitro site or the South Clive site, or along the transportation corridors. Hence, none of the 3 alternatives would affect historical or cultural resources. Other scenic values would be changed by the 3 alternatives; these changes are discussed below.

Alternative 1 would not affect scenic values at the South Clive site or in the transportation corridors, but minor changes in scenic values at the Vitro site could occur with development of the site by the CVWRF Board.

Alternative 2 would not affect scenic values at the South Clive site or in the transportation corridors. This alternative would change the visual character of the Vitro site. Long-term changes in the topography of the site are described in Section 5.3.1. During the remedial action, the direct visual impact at the Vitro site would result from site preparation and grading, erection of a security fence, and the piling and covering of tailings in the southeastern portion of the site. During the construction period, the increased activity at the site and related traffic would be visually obvious to nearby travellers and residents. Once stabilization is complete, the tailings piles (approximately 50 feet in height) and a security fence would be visible from nearby areas. These visual elements would be similar to the present appearance of the site.

The visual impacts at the Vitro site during the construction phase of Alternative 3 would be similar to those described for Alternative 2. With Alternative 3, visual impacts at the South Clive site would result from construction and stabilization activities and the continued presence of the tailings at the site. Construction of the rail spur or truck-access roads, and tailings disposal area would cause increased activity in the area which would be visible to travellers on I-80 and persons working in or touring the area. The tailings piles, the security fencing and the access roads would remain visible once stabilization is complete. Their appearances would contrast somewhat with the surroundings, which show little evidence of

human activity except for the existing rail line north of the site and south of I-80. However, the impact would be small because (1) most of the facilities would be about 2 miles from I-80, the nearest common vantage point, and would be seen by most viewers only at a distance, and (2) because the area is not visually attractive. As described in Section 4.11.2, a scenic-quality rating of 12 was assigned to the South Clive site, indicating no special management attention regarding visual resources is required.

5.9 IMPACTS ON POPULATIONS AND EMPLOYMENT

Alternative 1

Populations and employment trends described in Section 4.12.1 would be unaffected by the no-action alternative.

Alternative 2

Alternative 2 would not measurably affect populations and employment in Tooele County, the county in which the South Clive site is located. The impact of this alternative in Salt Lake County is described below.

Manpower requirements for Alternative 2 are shown in Table A-4 of Appendix A. Direct employment generated by the project would average 82 jobs during construction and stabilization while peak employment is estimated at 104 jobs. This level of employment represents less than 0.1 percent of the total Salt Lake County employment.

To the extent that purchases of construction materials and equipment (sand and gravel and heavy machinery) would cause supplying firms to increase employment, additional indirect employment effects would be realized. These effects would be small, since the materials and equipment requirements of the project would be relatively small. Additional service-sector employment caused by the respending of workers' wages (the "multiplier effect" described in Section 4.12.2) would also be small due to the low level of project employment. Assuming a regional multiplier of 2.5 (or 1.5 service sector jobs supported by every job created in the basic sector), 123 jobs would be supported in the service sectors of the local economy during construction.

Thus, a maximum of about 215 jobs could result from the project in the Salt Lake metropolitan area economy (assuming that 10 jobs are created by purchase of construction materials and machinery). This level of employment is less than 0.1 percent of the total employment in Salt Lake County of 273,848 during the second quarter of 1982 (Utah Department of Employment Security, 1982).

Based on the following considerations, immigration in response to employment opportunities created during construction is assumed to be zero.

- o Unemployment in Salt Lake County is currently 7.5 percent (State of Utah, Job Service, May 1983).

- o Unemployment among heavy equipment operators in the Salt Lake City area is currently 20 to 25 percent (State of Utah, Job Service, June 1983).
- o Unemployment among truck drivers in the Salt Lake City area is currently 10 to 15 percent (State of Utah, Job Service, June 1983).
- o Skilled construction workers from as far away as Provo and Ogden are willing to commute to the Salt Lake City area to take advantage of employment opportunities (State of Utah, Job Service, June 1983).

Alternative 3

Alternative 3 would affect populations and employment in Tooele County and in Salt Lake City. The impacts on populations and employment in both districts are described below.

Manpower requirements for Alternative 3 are shown in Tables A-7 and A-8 in Appendix A. Direct employment generated by the project at both sites would average 85 jobs for the rail transport option and 135 jobs for the truck transport option. Peak employment under rail transport and truck transport would be 130 jobs and 153 jobs, respectively. This level of employment would represent a maximum addition to Salt Lake County's total current employment of under 0.1 percent. Assuming that a maximum of one-half of the construction jobs are created in Tooele County, they would represent an addition of under 1.0 percent to Tooele County employment.

In addition, the CVWRF has stated that it will develop a temporary industrial park on the 3300 South Street portion of the Vitro site if Alternative 3 is the adopted remedial action. Based on this assertion, it is estimated that operation of the temporary industrial park will create 271 direct jobs and 434 indirect jobs in the regional economy (see Appendix H). This corresponds to less than 0.3 percent of total employment in Salt Lake County as of the second quarter of 1982 (273,848; Utah Department of Employment Security, 1982).

Stabilization south of Clive might also add employment in supplying firms due to purchase of construction materials, supplies, and machinery (such as heavy equipment, trucks, and rail cars). This effect would be short-term and small. The respending of project workers' wages would also increase employment in other economic sectors due to the "employment multiplier" process described in Section 4.12.2. If an average employment multiplier of 2.2 is realized in the Salt Lake and Tooele County economies, a maximum of 102 to 162 service-sector jobs would be supported (by basic sector employment) in the region in response to the respending of wages by 85 to 135 project employees. (The ranges reflect the different manpower requirements associated with the transportation options.)

The maximum impact of the project on regional employment would be 207 to 317 jobs depending on the transport option chosen. These figures include incremental employment in the supply industries of 20 jobs. The majority of these jobs would be created in Salt Lake County. The maximum effect of project-related employment on total County employment would be an increase of approximately 0.1 percent over current (1982) levels. If one-half of the new direct and indirect jobs were filled by Tooele County residents, Tooele County employment would increase by approximately 1.5 percent.

The creation of up to 317 jobs during the construction phase of the project, and 705 jobs in connection with the industrial park will not result in significant immigration into the area in response to the employment opportunities. In addition to the reasons noted in connection with the discussion of Alternative 2, above, unemployment among warehousemen, shipping and receiving personnel and clerks is currently between 20 and 25 percent in the Salt Lake City area (State of Utah, Job Service, June 1983). These are the types of skills that employers in an industrial park which catered to warehousing and distribution activities would be seeking. In addition, unemployment in Tooele County is currently (May 1983) 9.9 percent. Unemployment during 1982 also was 9.9. percent (State of Utah, Job Service, 1983).

5.10 IMPACTS ON HOUSING, COMMUNITY SERVICES, AND SOCIAL STRUCTURES

Alternative 1

The no-action Alternative would not affect housing, community services, or social structures in either Salt Lake County or Tooele County, the county in which the South Clive site is located.

Alternative 2

Alternative 2 would not measurably affect housing, community services, or social structures in either Tooele County or Salt Lake County.

Any project related growth in Salt Lake County would be minuscule in comparison to the current (1980) growth rate, which is estimated to be 3.5 percent per year or about 22,000 persons per year.

Alternative 3

Alternative 3 would not measurably affect housing, community services, or social structures in Salt Lake County or Tooele County.

As explained in connection with Alternative 2, any project-related growth in Salt Lake County would be minimal compared to the current (1980) growth rate of 3.5 percent per year. This corresponds to approximately 22,000 persons per year. To the extent that construction-related employment opportunities result in an immigration of workers into Tooele County, there could be a small and short-term impact on the availability of temporary

housing. However, for the reasons previously stated, it is anticipated that construction-related employment opportunities will be absorbed by the local labor force. This is due, in part, to the unemployment rate in Tooele County which is currently (May 1983) 9.9. percent, as well as the high unemployment rate among skilled construction workers in the region. In addition, it is estimated that 5.3 percent of the housing stock in Tooele County (8,566 units) is vacant. Therefore, to the extent that Alternative 3 results in immigration into Tooele County, the impacts on housing and social structure are expected to be minimal.

As previously noted, the CVWRF has stated that it will develop a temporary industrial park on the 3300 South Street portion of the Vitro site if Alternative 3 is the adopted remedial action. Based on this assertion, it is estimated that development of the temporary industrial park will result in 271 direct jobs and 434 indirect jobs (Appendix H). This corresponds to less than 0.3 percent of total employment in Salt Lake County as of the second quarter of 1982 (273,848; Utah Department of Employment Security, 1982). It is anticipated that the majority of these employees would be drawn from the local work force. Unemployment among warehousemen, shipping and receiving personnel, and clerks in the Salt Lake City area is currently estimated at 20 to 25 percent (State of Utah, Job Service, 1983).

5.11 IMPACTS ON ECONOMIC STRUCTURE

Impacts on the economic structure of Tooele County, Salt Lake County, and South Salt Lake, arising from implementation of the two action alternatives would range from no impact to a very small impact.

Alternative 1

Economic conditions detailed in Sections 4.12.2 for the State, Tooele and Salt Lake Counties, the cities of South Salt Lake, Tooele, and Grantsville would be expected to continue under the no-action alternative.

Alternative 2

Alternative 2 would have no predictable impacts on the economy of Tooele County.

Impacts of Alternative 2 on the economy of Salt Lake County would result from wages and benefits paid to employees and the purchase of materials, supplies, and services from local vendors. The largest contribution to the economy would be wages and benefits.

Wages paid to project workers are projected to total \$5.9 million up to completion of stabilization based on the employment schedule in Appendix A. Assuming benefits total 30 percent of wage costs, \$1.77 million in benefits would also be paid during stabilization.

Assuming that the respending of income would result in total personal income of 2.0 times the original income derived from wage and benefit

payments and an 18.8-percent-average tax rate for stabilization activities, personal income in Salt Lake County would rise by a total of approximately \$13.1 million due to stabilization at the Vitro site. Because this income-multiplier effect occurs as income is respent, some time would elapse after wages are paid before the full effect would be realized.

The impact of this increase in personal income on the Salt Lake County economy would be negligible given the current size of personal income for the County. Even if the \$13.1 million was realized in a single year, it would still represent approximately a 0.06 percent increase in the net Salt Lake County personal income (1980).

Purchase of materials, supplies, equipment, and minor services during Alternative 2 will amount to approximately \$16 million. Monitoring equipment may cost an additional \$500,000. Construction materials, supplies, and equipment would most likely be purchased or leased from local vendors. To the extent that major equipment purchases or leases are made out of state, the personal income associated with these purchases would accrue to out-of-state residents.

Wage payments for the project would increase state and Federal income tax receipts. Based on an estimated average net state income tax rate for stabilization activities of 3.7 percent, state income taxes would amount to \$218,000 during stabilization. The Federal income tax rate is estimated to be 15.1 percent of the total wages paid during stabilization. Thus, Federal income tax payments would amount to \$891,000 during stabilization. The respending of wage income would also result in increased state and Federal income taxes; however, this induced income would be realized in a number of forms (individual and corporation income, interest income) and is, therefore, not quantified in this analysis. Local purchases of supplies, equipment, and materials would also result in increased state, sales, use, and gasoline taxes.

Alternative 3

Stabilization south of Clive would result in wage payments to residents of both Salt Lake County and Tooele County, increasing personal income in both counties. This impact, while beneficial, would be very small given the present magnitude of personal income in the combined counties.

Wages paid to project workers are projected to be \$7.2 to \$11.7 million up to the completion of stabilization at South Clive depending on the transport option chosen. These estimates are based on the employment schedule in Appendix A. Assuming benefits total 30 percent of wage costs, benefits would total \$2.16 to \$3.51 million. Eighty percent of these wages are assumed to be paid to Salt Lake County residents and 20 percent to Tooele County residents.

Much of the personal income accruing to Tooele County residents is ultimately spent in Salt Lake County, which provides many of Tooele County's goods and services. Thus, the income multiplier is much lower in Tooele County than Salt Lake County because of income "leakage" to Salt Lake County.

If an income multiplier of 1.5 is assumed for Tooele County, the total personal income derived in the county from wage payments to Tooele County residents would be \$2.4 to \$3.9 million during stabilization at the South Clive site (assuming a tax rate of 18.8 percent). This would represent a maximum increase of approximately 2.2 percent in the current total county personal income.

Assuming that an income multiplier of 2.0 applies to wage and benefit payments to Salt Lake County residents and that a multiplier of 0.4 applies in Salt Lake County to wages paid to Tooele County residents, approximately \$13.5 to \$21.9 million in total personal income would accrue to Salt Lake County residents from wage payments during stabilization. This would represent a maximum increase in the total Salt Lake County personal income of approximately 0.1 percent.

In Alternative 3, purchases of materials supplies, equipment, and minor services would amount to approximately \$52 million for the train transport option and \$50 million for the truck transport option. These figures include all nonlabor and site acquisition costs. The majority of the materials, supplies, and equipment would be purchased or leased from local vendors. The income that would be realized in the local economy from these purchases/leases is included in the analyses in the preceding paragraphs. To the extent the major equipment purchases or leases are made out of state, the personal income associated with these purchases would accrue to out-of-state residents.

Based on an estimated average Utah state income tax rate for stabilization activities of 3.7 percent, state income tax receipts would amount to \$266,000 to \$433,000 during stabilization. The Federal income tax rate is estimated to be 15.1 percent of the total wages paid during stabilization. Thus, Federal income tax payments would amount to \$1.1 to \$1.8 million during stabilization. The respending of wage income would also result in increased state and Federal income taxes; however, this induced income would appear in a number of forms (individual and corporate income, interest income) and is, therefore, not quantified in this analysis. The State of Utah would also receive sales and use taxes from purchases of materials, supplies, and equipment for the project.

The South Clive site is in state ownership under the control of the Division of State Lands and Forestry. If lands are purchased from the State of Utah, the purchase price would be at the fair market value of the land (about \$50 per acre). If a lease were used, the annual cost would be the prime interest rate times the fair market value of the land permitted for use. No other permit charges would be levied for use of the South Clive site.

5.12 IMPACTS ON TRANSPORTATION NETWORKS

Alternative 1

With the no-action alternative, transportation networks and their traffic loads would be as noted in Section 4.12.6.

Alternative 2

The impact on transportation networks of stabilization at the Vitro site would be limited to haul trucks, miscellaneous deliveries, and employee commuter traffic. Access to the site would be via a new entrance which would feed 900 West Street approximately 1200 feet north of 3300 South Street. Miscellaneous deliveries and commuter trips would be expected to impact the intersection of 3300 South Street and 900 West Street. Haul trucks would not impact this intersection or any of 3300 South Street. The expected haul route would be north on 900 West Street to 21st West Street, then west on 21st South Street to 5600 West Street, then south on 5600 West Street to 5400 South Street, then west on 5400 South Street to 6000 West Street--a distance of approximately 13 miles. Although this is not the most direct haul route it avoids impacting 3300 South Street as well as residential areas. Hauling would avoid peak-hour traffic periods. Heavy construction equipment would be stored at the site. The primary source of project traffic would be commuting by workers and truck hauling of the estimated 1.865 million cubic yards of fill needed for stabilization and restoration. A maximum of about 210 daily trip-ends at the site is expected based on the manpower schedule in Appendix A. Assuming each haul truck carried 26.5 tons, about 200,000 trip-ends at the site would be necessary over an approximate 510 working-day period, for an average of about 395 trips per day. Assuming that miscellaneous trip-ends at the site would total about 50 per day, a total of 655 vehicle trip-ends at the site are projected.

Table 5-10 shows the expected impacts to the local roadway network as a result of Alternative 2. The maximum percentage increase along the affected network is estimated to be 8.5 percent. This maximum increase would be along 5400 South Street. However, this roadway, and all other roadway segments along the haul route, would be expected to show no signs of significant congestion as a result of the remedial action. The increase in roadway surface loading from the haul truck would be expected to require maintenance of portions of the haul route which are not designed to withstand these types of load cycles. This could include surface patching, complete resurfacing, or structural maintenance.

Table 5-10. Current, projected, and projected with remedial action average daily traffic (ADT) along the haul route. Alternative 2.

Roadway section	1982 ^a ADT	Estimated 1986 ^b ADT	1986 plus remedial action ADT
900 West between 2100 S & 3300 S	9300	10,265	10,920 ^c
2100 South between 900 W & 1200 W	56,775	62,670	63,065
1700 W & 3200 W	40,285	44,470	44,865
3200 W & 3600 W	27,600	34,465	34,860
3600 W & 5600 W	25,325	27,950	28,345
5600 West between 2100 S & 3500 S	10,725	11,840	12,235
3500 S & 3600 S	8350	9215	9610
4100 S & 5400 S	7225	7975	8370
5400 South between 5600 S & West	4200	4635	5030

^aUDOT, 1984.

^bAssuming a 2.5% per year increase in traffic.

^cIncludes all commute and miscellaneous trips.

Alternative 3 - Train

Stabilization south of Clive would result in increased road traffic to the South Clive site and the Vitro site, as well as increased rail traffic on the Denver and Rio Grande Western and the Union Pacific rail lines between the Vitro and South Clive sites. The increase in road traffic (a maximum of 110 trip-ends per day) near the South Clive site would not be significant since traffic levels on I-80 are well below the highway's capacity and because of the low level of worker and heavy-equipment traffic projected for the site. Heavy equipment used at either site would be stored at the site. Workers commuting to and from the Vitro site would add an average of approximately 145 commute period trip-ends per day and a peak of approximately 160 commute period trip-ends per day to traffic volumes on access roads to the Vitro site, primarily 3300 South Street and 900 West Street. Assuming miscellaneous trips total 50 per day (ingress and egress), approximately 210 vehicle trips per day, or less than 1 percent of current traffic levels, would be added to 3300 South Street and 900 West Street. The impact of this level of traffic would be small.

Vitro site restoration would require the importation of approximately 1,040,000 cubic yards of material from the borrow site identified in

Alternative 2. It is anticipated that this would be accomplished using a fleet of seventeen, 18.5 cy-haul trucks. This fleet would increase the average workday traffic along the haul route by about 170 trips per day over the 625-workday period. Workers commuting to and from the Vitro site would be expected to add 50 trip-ends per day. These would be expected to occur during the morning and evening peak hours. Miscellaneous trips are assumed to add 50 nonpeak-hour trips per day to the local network. Therefore, the Vitro site restoration phase (train) would be expected to increase traffic by a maximum of 4 percent along the haul route and less than 1 percent to the local network.

Rail traffic between the Vitro and South Clive sites would be two unit-train trips per day. Discussions with representatives of the Union Pacific railroad indicated that no difficulties would be encountered in scheduling this level of rail traffic.

Alternative 3 - Truck

Stabilization at the South Clive site using 35-ton capacity trucks to transport the contaminated materials from the Vitro site to South Clive would increase road traffic between the two sites and along the commuting routes to these sites. This option would have no effect on the rail systems in the area. It is expected that this option would add a maximum of approximately 50 commute trips per day to the roadway network near Clive. This increase in road traffic near the South Clive site would not be significant since the traffic levels on I-80 are well below the highway's capacity. Heavy equipment used at either site would be stored at the sites. Worker commuting to the Vitro site would add an average of about 230 and a maximum of 260 commute period trips per day to the access roads to the Vitro site. Contaminated materials hauling is estimated to add 300 trips per day along the haul route to the South Clive site. Assuming miscellaneous trips to this site total 50 per day, approximately 610 vehicle trips per day would be added to the local roadway network near the Vitro site. All of the haul trips (300 per day) would be impacting 900 West Street to 2100 South Street, 2100 South Street, through Magna, to its intersection with I-80 and I-80 to the South Clive site. These roadway segments have sufficient traffic capacity to accept this level of increased traffic (UDOT, 1984). However, portions of 2100 South Street, in particular the older, two-lane sections, may not have sufficient structural capacity to withstand the loads of the haul truck without periodic maintenance to the surface or structural components of the roadway.

Vitro site restoration for this option could be the same as site restoration for the train option except that slightly more clean fill would be required to be imported. The truck fleet would be increased to produce approximately 190 trips per day. The additional 20 trips per day over the train option would not significantly change the consequences of the increased traffic along the haul route or local roadway network.

5.13 USE OF ENERGY AND OTHER RESOURCES

Each of the action alternatives would require the use of electricity, fuel, water, manpower, and construction materials. The use of water,

manpower, and soils would not be a commitment of nonrenewable resources, but the uses of electricity, engine fuel, concrete, and nonsalvageable steel would be. The amounts of electricity, engine fuel, and concrete used in Alternatives 2 and 3 are shown in Table 5-11.

Electricity would operate the lights and the dewatering pumps at the Vitro site. Electricity at the South Clive site could be provided by an on-site generator powered by engine fuel. Engine fuel would be required for the earthmoving equipment and construction-related machinery used in both alternatives; it would also be used to power the railroad engines that move railroad cars in Alternative 3. All of these electricity and fuel requirements are tabulated in Table 5-11. Engine fuel and electricity are in ample supply in the Salt Lake City area .

Minor amounts of concrete would be needed to construct the foundation for the railroad unloading equipment at the South Clive site.

Table 5-11. Energy and other resource requirements

Resource	Alternative		
	2	3 (train)	3 (truck)
Electricity (kwh)	400,000	800,000	800,000
Engine fuel (gal)	2,520,000	6,970,000	7,121,000
Concrete (cu yds)		400	0

5.14 NONRADIOLOGICAL IMPACTS OF ACCIDENTS

In the two action alternatives, the major potential hazards would be those typically associated with construction sites, i.e., equipment-related hazards and the hazards of falling into excavations. There would also be potential transportation hazards involving truck drivers and other highway users and railroad workers. The expected numbers of work-related accidents have been calculated for each action alternative; the results of the calculation are summarized in Table 5-12.

Table 5-12. Expected number of work-related accidents^a

Type	Alternative 2	Alternative 3	
		Train	Truck
Accidental deaths among:			
Construction workers ^b	0.025 ^d	0.066	0.045
Truck drivers	0.13	0.07	0.47
Railroad crews	--	0.004	--
Disabling injuries ^c among:			
Construction workers ^b	9.45	24.6	16.9
Truck drivers	2.16	1.25	8.04
Railroad crews	--	0.90	--

^aCalculated using manpower schedules in Appendix A, and incidence rates given in DOT, 1977; Ramana et al., 1982; and NSC, 1982).

^bConstruction workers do not include administrators, managers, aides, monitoring personnel, or secretaries.

^cA "disabling injury" is an injury involving death or lost work days.

^dThe expected number of deaths can be related to the individual worker's chances of death in an accident if the size of the work force is known. For example, "0.025 expected accidental deaths" among a work force of about 58 workers (Alternative 2) means that each worker's chance of a fatal accident would be, on the average, $0.025/58 = 0.0004$ or 0.04 percent.

5.15 RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

Alternative 1

The entire Vitro site is owned by the Central Valley Water Reclamation Facility (CVWRF) Board. The current plans to establish a temporary industrial park, a regional waste-water treatment plant, a waste-recycling facility, and a municipal ground-water pumping facility at the site (all described in Subsection 4.9.1) might not be implemented under the no-action alternative. Expansion of the CVWRF facility to 100 million gallons per day (mgd) depends on the relocation of the tailings within the site by the Federal government. The CVWRF Board began construction in 1981 and the expansion of the facility to a capacity of 50 mgd is continuing.

The no-action alternative would not affect the zoning in the area of the Vitro site. The south portion of the Vitro site is currently zoned for business uses. However, the development of a temporary industrial park along the 3300 South Street corridor, which would require a zoning change, might have to be abandoned if the no-action alternative were implemented.

Alternative 2

Implementation of Alternative 2 would, in the short term, conflict with the CVWRF Board's proposed plans for leasing a 300-foot strip of the site along 3300 South Street to business interests. In the long term, implementation of Alternative 2 could force the CVWRF Board to revise plans for expanding the waste-water treatment plant to a capacity of 100 mgd. However, under Alternative 2 approximately 20 acres in the southwest portion of the site will be available for development. Potential uses include a temporary industrial park, a municipal solid waste-to-energy facility and a municipal ground-water facility (see Section 4.9.1).

Alternative 3

As stated above, the CVWRF Board's long-term plans for development of the 128-acre Vitro site apparently depend upon the decontamination of the site by the Federal government. Implementation of Alternative 3 would realize these expectations, and would be in accord with the CVWRF Board's planning.

Alternative 3 would not seriously conflict with land-use plans for the South Clive site. Although most of the land within a 10-mile radius of the South Clive site is public domain administered by Bureau of Land Management (BLM), the section on which the actual disposal area would be located is owned by the State of Utah. Sheep grazing, transportation, hunting, and recreational-vehicle driving are the only uses made of this section of land. The State derives some revenue from the section by issuing grazing and mineral exploration permits, but otherwise it has no plans for use of the South Clive site. Tooele County has no zoning designations within a 10-mile radius of the site.

5.16 UNAVOIDABLE ADVERSE IMPACTS

The major adverse impact of Alternative 1 would be the continued presence of above-background levels of radiation at and near the Vitro site and the continued exposure of workers and the public near the site to enhanced concentrations of Rn-222 and its daughter products. A second impact of Alternative 1 would be the inability of the CVWRF to expand its sewage-treatment plant to 100 mgd.

The major adverse impact of Alternative 2 would concern land use: the CVWRF Board would not be able to use 53 acres of the 128-acre site; however, Alternative 2 would permit most anticipated uses for the 75 acres of the land that would be decontaminated. Temporary but nevertheless unavoidable impacts of Alternative 2 would be construction noise, dust from construction activities, and some increase in the traffic on routes leading to the southern boundary of the site. Also, workers on the site would be unavoidably exposed to above-background levels of radiation during the 2.5-year term of the remedial actions.

As in Alternative 2, the major adverse impact of Alternative 3 would fall on plans for land use. But in this case, the impact would fall on the State

of Utah's plans for using the South Clive site as a revenue-producing property. The long-term impact of Alternative 3 on the Vitro site would be wholly beneficial in that all of the 128-acre tract would be decontaminated and used according to the CVWRF Board's current plans. Temporary but nevertheless unavoidable impacts of Alternative 3 would be similar to the ones in Alternative 2; there would be noise and dust from construction activities at the Vitro site, and construction workers, truck drivers, and railroad crews would be exposed to above-background levels of radiation during the 3-year term of remedial actions.

5.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Alternatives 2 and 3 would require the same types of resource inputs. These include electricity, engine fuel, backfill and cover material, manpower, water, and land. The only resources among this list that are irretrievably lost after use are electricity and engine fuel; the amounts of these resources that would be used in the two alternatives are detailed in Section 5.13. The use of water is not a permanent commitment of a resource. Even the use of backfill and cover material, and land in general, would not be completely permanent commitments; if permitted by law, either of the two alternative disposal sites could be reexcavated in the future and the materials and mineral values they contain could be salvaged.

5.18 RELATIONSHIP BETWEEN THE SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Under Alternative 1, no action, there would be no short-term use of the environment. Full development of the long-term productivity of the Vitro site lands would be precluded for an indefinite period of time since unstabilized tailings would remain on the site.

In Alternative 2 the Vitro site and its immediate surroundings would experience the inconveniences of construction activities for 2.5 years; there would be noise and dust from these activities, some increase in traffic congestion, and construction workers would be subject to above-background levels of radiation. This period of inconvenience would, however, lead to a substantial increase in the long-term productivity of the 128-acre tract. In fact, the amount of potentially productive lands on the site would increase from nearly zero acres to 75 acres.

Under Alternative 3 the Vitro site and the South Clive site would experience construction activities for 3 years. As in Alternative 2, there would undoubtedly be inconveniences to the owners and neighbors of the Vitro site from these activities. Potential inconvenience to persons near the South Clive site is considered to be negligible. But again, the 3-year period of inconvenience in Alternative 3 would lead to an even more substantial increase in the long-term productivity of the 128-acre tract; it would cause the entire site to be potentially useful land. The 60-acre (55 acres for the embankment, 5 acres for ancillary facilities) South Clive site would, on the other hand, be permanently removed from public or private use. Since the potential

productivity of the Vitro site is so much larger than that of the South Clive site, the net long-term productivity of lands would be enhanced by Alternative 3.

5.19. MITIGATION MEASURES DURING THE REMEDIAL ACTIONS

Several mitigation measures to be taken during the action alternatives have already been described in previous sections of this document. These measures are planned ones and would be adopted as part of the normal procedures during construction activities. Such planned mitigation measures are briefly recapitulated in this section. The major emphasis of this section will be upon those mitigation measures that are possible but to the implementation of which neither the DOE nor the State of Utah have committed themselves at this time.

5.19.1 Mitigation of impacts on land use

There are no planned actions for mitigating the impacts on land use in any of the three alternatives. Some possible mitigation measures are the following ones.

As stated before, the major impact on land use of Alternatives 1 and 2 derives from the inability of the CVWRF Board to expand its sewage-treatment facility to 100 million gallons per day if any tailings are left on the 128-acre site. To mitigate this impact, the State of Utah might acquire uncontaminated, vacant lands adjacent to the site and exchange them with the CVWRF Board for all or part of the presently contaminated 128-acre tract, depending on whether Alternative 1 or 2 is implemented. The CVWRF Board would of course have to change their long-term development plans under either alternative, so this possible but-not-proposed land exchange may not totally mitigate the adverse impacts of Alternatives 1 and 2 on land use. It should also be noted that under Alternative 2, 20 acres in the southwest portion of the Vitro site will be available for development. To the extent that development consistent with the CVWRF's approved Master Plan is undertaken, it will be possible to partially mitigate the adverse impacts of Alternative 2.

As stated before, the impact on land use of Alternative 3 derives from the loss of the South Clive site by the State of Utah as revenue-producing lands. To mitigate this impact, the DOE might acquire an adjacent section of Federal lands and exchange it with the State of Utah for the section of State land that contains the South Clive site.

5.19.2 Mitigation of impacts of releases of radiation

Planned actions for mitigating exposure of construction workers to radiation during Alternatives 2 and 3 include dampening exposed contaminated material or covering it with sealants, tarps, and plastic sheeting to prevent dust blow off; stopping the handling of contaminated materials during periods of heavy wind; the provision on request of protective equipment such as masks to the remedial-action workers; and the use of lids and plug seals on the rail cars that carry the materials in Alternative 3. Contamination of the railroad

bed would be prevented by the washing down of the rail cars before they leave the construction sites. Public exposure to radiation during the construction phases would be limited by restricting access to the project's sites.

If Alternative 1 should be implemented, a possible action that would somewhat mitigate exposure to radiation would be the following: either the DOE or the State of Utah might fence the more-contaminated parts of the 128-acre site and suppress dust by wetting down those areas in periods of dry weather and heavy wind. This action might also include direct surveillance of the fenced site by security personnel, in order to prevent further removal of tailings from the site and the concomitant creation of new "vicinity" properties.

5.19.3 Mitigation of impacts on water

Planned actions for mitigating the impacts of construction activities on surface waters during Alternatives 2 and 3 include using evaporation ponds for the isolation of construction-process water that exceeds the permission-to-discharge standards; and constructing temporary dikes to contain potentially contaminated runoff waters that form during heavy rains.

5.19.4 Mitigation of impacts on noise

The construction-activity plans for Alternatives 2 and 3 would include some means for reducing the impacts of noise whenever and wherever it is necessary. Mufflers would be used on vehicles and equipment, and noisy activities at the Vitro site would be scheduled for daytime hours. The haul routes were selected to avoid sensitive receptors.

5.19.5 Mitigation of impacts on transportation networks

The commercial suppliers of cover and fill in Alternatives 2 and 3 would be required to use only those high-capacity roads that lead to the Vitro site as described in Section 5.12 and to avoid schedules and routes that could cause annoyance to the public and congestion of high-use intersections. If required, structural maintenance of the haul route would be incorporated into the project design plans.

In Alternative 3, the use of the railroads to transport materials between the two sites and the choice of the South Clive site are planned actions intended to mitigate impacts on transportation networks. The use of the railroad for transporting the material would avoid the additional congestion of heavily travelled public highways that would be caused by a fleet of 35-ton capacity trucks (it would take 77 such trucks making two round trips per day to carry the 5400 tons per day that the railroad would carry).

5.19.6 Mitigation of impacts from seismic events

Vitro

The results of a seismic risk study, as described by Sergent, Hauskins and Beckwith (1983), at the Vitro site are presented in Appendix H. The study

concluded that saturated zones within the tailings and zones of the native soils below the water table are susceptible to seismically induced liquefaction. If the Maximum Credible Earthquake (MCE) were to occur with the saturated conditions of the subsoils and tailings, the side slopes of the final embankment could slide. The remedial action as described in this document contains a mitigation for the seismically induced liquefaction. As explained in Appendix A, all of the tailings will be excavated, and compacted in the embankment. The movement and mixing of the tailings will desaturate the material. As the material is replaced it will be compacted in lifts to stabilize the base of the embankment for the placement of the remaining material and the cover. The desaturated tailings will no longer be subject to liquefaction. Should a major seismic event occur, liquefaction of the subsoils below the embankment is possible. However, the damage to the embankment would be reduced to minor surface cracking of a few inches. Any damage to the cover poses no hazard to the public and could be easily repaired.

South Clive

At the South Clive site, the potential for damage is much less since the chances of seismically induced liquefaction are much less than for the Vitro site. Additionally, the tailings would be dewatered, mixed, and compacted during placement so as to reduce the possibilities for within-embankment liquefaction to a very low level. An MCE would still probably cause some minor cover cracking, most of which would be self-healing; but this damage would pose no hazard and would be easily repairable.

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6 PUBLIC AND AGENCY COMMENTS

This chapter discusses the comments made by private citizens and government reviewers (Federal, state, and local) on the draft environmental impact statement (DEIS) for remedial actions at the former Vitro Chemical Company site in South Salt Lake, Utah.

Comments on the DEIS were obtained from the public, citizens groups, and government agencies during 2 days of public hearings and a 52-day* written-comment period. The public meetings were held in Tooele and South Salt Lake, Utah, on March 22 and 23, 1983. A total of 53 persons presented oral statements on the DEIS. Twenty-six letters, some longer than 20 pages, were received during the written-comment period. Table 6-1 lists the persons who presented oral statements at the public hearings, and Table 6-2 lists the persons, groups, and agencies that submitted written comments. (These tables may be found at the end of Section 6).

To put all the comments in an easily accessible form, each oral statement (recorded by a certified stenographer) and letter was analyzed in detail, and comments on specific issues were identified. A preliminary outline of this chapter was prepared, and each comment was categorized according to the subsections of this outline. Notebooks were prepared in which all comments on a specific topic (e.g., ground water at the Vitro site) were brought together in one place. This system allowed the preparers of this FEIS to consider all comments received on a topic while revising the parts of the document dealing with that topic.

To consolidate the discussion of the voluminous response to the DEIS, the comments have been grouped into 19 major topics that cover all the substantive comments received. Each of these topics deals with one or more issues, which are listed in this chapter as part of the discussions of the 19 topics. This chapter summarizes the topics and issues and the responses of the DOE to the comments. Where the responses required changes in the text of the DEIS, they appear in the main text of this FEIS. For example, the State of Utah disagreed with the cost estimates presented in the DEIS. In responding to this comment, the DOE has met with the state to compare details of its cost estimates with those of the state and has changed its estimates to those presented in Table 1-3 and Appendix A. Finally, a twentieth section was added to include those comments that did not directly comment on the DEIS, but which should be acknowledged and, in some instances, responded to.

Sections 6.1 through 6.5 discuss the legal basis of the proposed remedial action and the choice of alternatives. Sections 6.6 through 6.10 discuss sites (Vitro and South Clive), various matters related to the engineering designs of the alternatives, and the direct and indirect costs of the alternatives, including the requests for a more thorough economic analysis of the project.

*The EPA notice of availability of the DEIS was published in the Federal Register on February 18, 1983 (Vol. 48, p. 2794-2796). This notice allowed a 52-day comment period, through April 11, 1983. However, all written comments received by the DOE were considered in this final environmental impact statement (FEIS).

Sections 6.11 through 6.15 discuss comments on the noneconomic impacts of the alternatives: the radiological and nonradiological impacts of routine portions of the remedial actions and of the accidents that may occur, as well as comments on land use and psychological impacts. Sections 6.16 through 6.18 discuss monitoring during and after the remedial action, mitigation of impacts, and archaeology. Section 6.19 discusses those comments which are editorial in nature.

Finally, Section 6.20 discusses the comments that dealt with topics considered to be outside the scope of this FEIS.

Table 6-3 at the end of Section 6 provides an extensive set of cross-references between the substantive issues and the letters and oral statements providing comments.

Section 6.21 of this FEIS reproduces in full the written comments received on the DEIS. Transcripts of the public hearing, are available for inspection at each of the public reading rooms and libraries listed at the beginning of Section 6.21.

6.1 COMPLIANCE WITH NEPA

The compliance of the Vitro DEIS with the National Environmental Policy Act (NEPA) and with the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA was commented on in 5 letters and 3 oral statements. The comments are summarized below. A response to each issue is also provided.

1. Comment.

The DEIS does not comply with NEPA or the CEQ Regulations because it does not adequately address certain economic impacts of the remedial action. (15, 16, 23, 207, 209, 212, 213)

- o The Governor of Utah, the Central Valley Water Reclamation Facility Board, their economist, and a Salt Lake County commissioner said that the DEIS has grossly underemphasized the indirect and long-term costs of stabilization in place.
- o They also asserted more generally that the economic analysis of the project is not adequate.

Response.

Since the DEIS was published in February 1983, the DOE has made a further analysis of the costs and economic implications of alternatives 2 and 3 in order to better understand and comment on the state's and board's analyses. The several sets of analyses are compared and discussed in Section 6.10 below, and appropriate changes have been made in Sections 5.9 and 5.11 and Appendix E of this FEIS.

2. Comment.

A DEIS should not be used to rationalize or support a decision already made by an agency required to complete a NEPA document. A DEIS should state a preferred alternative if one exists. It appeared to a number of commentors, including the Governor and a Salt Lake County commissioner, that the DEIS implicitly supported stabilization in place at the Vitro site. (16, 23, 209)

Response.

At the request of the state, the DOE did not identify a preferred alternative in the DEIS. Since then, the Secretary of Energy has agreed with the state that relocation is preferable and this has been identified as the preferred alternative in this FEIS.

3. Comment.

The DEIS indicates that additional ground-water data are being acquired. It also says that the design for stabilization in place may change as the result of these data and/or the fact that the final EPA standards are not as strict as the proposed EPA standards. NEPA regulations (40 CFR 1502.9) require the preparation of supplements within drafts or final environmental impact statements if "there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." It may be that a new or supplemental draft is in order with subsequent opportunity for public review and comment. (23, 110, 213)

Response.

Additional ground-water studies have been completed since the DEIS was issued and have been made available to state and local officials, the NRC, and the EPA. It is the DOE's decision, with which the state has expressed agreement that these data do not contribute significant new information and therefore do not warrant a supplement to the DEIS. These studies are included in Sections 4.6.2 and 5.4, and Appendix D of this FEIS.

6.2 EPA AND OTHER REGULATIONS

Comments on various regulatory aspects of the Vitro remedial actions were received in 6 letters and 6 oral statements. These comments are summarized below and a response to each issue is provided.

1. Comment.

The Sierra Club, other public interest groups, and the State of Colorado have entered a suit in Federal Court in Denver asserting that the EPA regulations the DOE is working under are inadequate. The Sierra Club's representative said that if more adequate regulations were in force, only moving to South Clive would be acceptable. Thus if the tailings are stabilized in place, the DOE may be forced to come back and dig the tailings up again. (51)

Response.

The DOE is aware of several suits filed against the EPA, and although it is not a defendant, it is following them closely because of their potential affect on the UMTRA project. However, the DOE must proceed with the project on the basis of the final EPA standards (issued January 5, 1983). These have been issued in final form, and the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA, PL95-604) establishes a deadline of March 1990 for completing the project. In any event, the DOE's preferred alternative identified in this FEIS is to move the Vitro tailings to the South Clive site.

2. Comment.

The Central Valley's economist and two private citizens said that the EPA regulations are certainly necessary, but they implied that they may not be sufficient to protect the public health. (16, 24, 39)

Response.

The UMTRCA directs the DOE only to perform remedial actions that will leave the tailings in a condition that will conform to the EPA standards. It puts the NRC in the role of judging whether the actions do in fact conform. The DOE is not authorized to spend government funds to exceed these standards.

The EPA standards themselves have been the subject of an EIS, and by the tiering principle (40 CFR 1502.20) they need not be addressed again in this FEIS.

3. Comment.

The CVWRF Board's general manager said that the Nuclear Regulatory Commission regulations for low-level waste (10 CFR 61) are applicable. These regulations require: 1) a design that will provide for long-term isolation avoiding the need for continuing active maintenance, 2) a buffer zone about the waste (he said of 30 meters width), and 3) that wastes not be in contact with standing water at its highest seasonal fluctuation. (15)

Response.

The NRC regulations for the land disposal of low-level radioactive waste (10 CFR 61) do not apply to the UMTRA project. The definition of low-level radioactive waste specifically excludes uranium or thorium tailings (10 CFR 61.2).

4. Comment.

There were a variety of comments relative to whether the alternatives, especially stabilization in place, adhere to the EPA standards.

o Comment a

The critics referred to the statements in the standards that say that "judgments on the possible need for remedial or protective actions for ground-water aquifers should be guided by relevant considerations described in EPA's Hazardous Waste Management System (47 FR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the period of

stabilization." This may in fact constitute a more restrictive set of requirements than the ones the EPA proposed initially. (18, 202, 204, 209, 212)

- o Response a
The DOE agrees that the statements in the final EPA standards referred to by the critics could in some cases prove to be more restrictive than the numerical standards appearing in the proposed version of the standards.
- o Comment b
The Foreword to the DEIS says that the designs finally adopted can be expected to be different because the final EPA standards are somewhat less stringent than the (previously) proposed standards. This statement was disturbing, especially since it is not true as regards ground-water protection. (18, 202)
- o Response b
It is agreed that the statement in the Foreword to the DEIS, "Because the final EPA Standards are somewhat less stringent than the proposed standards, all of the action alternatives . . . will satisfy . . . final standards," could prove to be logically false because of the new ground-water protection guidelines in the final EPA standards. The original thought behind this statement focused on the less stringent, radon-protection guidelines which certainly warrant changes in the design of covers and the requirements on removal of soil from open lands.

In this FEIS, the analyses and designs have been modified to comply with the final EPA Standards. Additional ground-water studies (field studies, contaminant transport, and modeling) and cover design studies (erosion, infiltration, and radon attenuation modeling) have been conducted and the designs for Alternatives 2 and 3 modified accordingly.
- o Comment c
There was concern lest the DOE "back away from the guidelines" by taking advantage of the provision in the EPA standards for exceptional circumstances. (18, 202)
- o Response c
It is assumed that the comments in referring to the "provision in the EPA Standards for exceptional circumstances" meant the Sections 192.22, Supplemental Standards, and 192.21, Criteria for Applying Supplemental Standards, in the final EPA standards. The EPA criteria for applying supplemental standards clearly preclude application of any but the regular standards (Subparts A or B) to remedial actions at high-priority, former processing sites such as the Vitro site (FR 48, No.3, pg. 605, summary).

- Comment d
The Governor said, "Major portions of the final EPA standards are not addressed, nor is Congressional intent noted. The Uranium Mill Tailings Radiation Control Act reflects (in Section 206) Congressional desire that EPA's standards be consistent, to the maximum extent practicable, with the Solid Waste Disposal Act." (209)
- Response d
A discussion of the final EPA standards, and the DOE's interpretation of those standards, including their consistency with Congressional intent, is contained in Section 3.1.1 of this FEIS. The alternatives described in Appendix A and elsewhere have been developed to comply with all of the provisions of the final standards.
- Comment e
The EPA was quoted to the effect that an "optimized cost-benefit rather than a 'least cost' alternative... provides much greater protection of health at only a slight increase ((in cost))." The DOE should do likewise. (207)
- Response e
Agreed.
- Comment f
The EPA was also quoted to the effect that "the single most important goal of control ((is)) effective isolation and stabilization of tailings for as long a period of time as is reasonably feasible." The DOE would have great difficulty certifying the required longevity. (207)
- Response f
The DOE believes that the EPA's ". . . single most important goal of control . . ." is achievable with either of the action alternatives in the FEIS; otherwise, these alternatives would not have been considered. The implementing agencies must provide "reasonable assurance" that the provisions of Subparts A and B of the final EPA standards are satisfied by the disposal scheme that is finally implemented.
- Comment g
There is no mention of RCRA in the document. "Utah is adamant that RCRA requirements be carefully considered..." (212)
- Response g
Except for ground-water protection, the Resource Conservation Recovery Act (RCRA) of 1977 does not apply to the UMTRA project.
- Comment h
The Public Health Service of the U.S. Department of Health and Human Services said that they thought that either remedial action will meet EPA standards. (215)

- o Response h
Agreed.
- o Comment i
Active controls cannot be counted on to ensure the longevity called for in the EPA standards. (110, 207)
- o Response i
Agreed. Neither action alternative would require an active maintenance program to ensure their longevity.

6.3 NRC AND STATE CONCURRENCE

A number of persons (in 5 written and 2 oral statements) dealt with the need for state concurrence in any remedial action taken on the South Salt Lake tailings pile. There were no comments on the process of concurrence by the NRC.

Comment.

- o The Governor and others pointed out that the UMTRCA anticipates a mutually satisfactory and acceptable course of action with respect to the Vitro tailings. The implicit preference seen in the DEIS for stabilization in place is not such a mutually satisfactory resolution of the problem. (1, 17, 109, 209, 211, 213)
- o Going further, the state said it would not "undertake responsibility for actual acquisition of" the Vitro property, if stabilization in place were the alternative decided upon. (209, 212)

Response.

These issues are beyond the scope of this EIS, whose function is rather to set forth the environmental consequences of the several alternatives for the remediation of the Vitro tailings problem as one of several bases for the decision among them. These issues are discussed further in Section 6.20.

6.4 SCHEDULE

A number of persons (in 4 written and 9 oral statements) criticized the rate at which progress is being made towards actual physical remedial action on the Vitro tailings.

1. Comment.

The general tenor of these criticisms was that there is too little progress being made towards actually "moving dirt." People used such phrases as, "haven't we studied this enough?" and "cycle of indecision." Congressman Marriott is "extremely upset with the length of time that has

elapsed ((since PL95-604 was passed))." The governor stated that "The relocation of these tailings must begin this year." (1, 17, 28, 34, 36, 41, 47, 48, 105, 109, 206, 209)

Response.

The UMTRA Project must be conducted according to the provisions of its enabling legislation, UMTRCA, and other broadly applicable laws, such as the National Environmental Policy Act of 1969, as amended. These laws in effect determine the UMTRA Project's schedule for conducting remedial actions by requiring an unusual degree of coordination and agreement between the different Federal agencies involved in the project, and also between the DOE and the affected states or tribes. The DOE believes that it has made an earnest effort to coordinate its UMTRA Project tasks with the EPA and NRC, and to obtain agreement with affected states, in particular the State of Utah. Indeed, the Vitro site in South Salt Lake has received special attention because of its location in a highly populated area: remediation of vicinity properties was begun in 1981 as soon as EPA's interim standards were promulgated; concurrence of Utah in specific proposals for cleanup of the Vitro site was sought by the DOE in numerous drafts of the Remedial Action Concept Paper that were submitted to the State in 1981-1982; and--in spite of the extra expense--the NEPA process leading to this EIS was initiated early, before receiving State agreement on a proposed action, in order to more fully develop the issues on which agreement would depend. Based upon this history and assuming satisfactory completion of the NEPA process, the proposed remedial action is scheduled to begin upon completion of the final design by the State of Utah.

2. Comment.

An owner of a business at the southwest edge of the Vitro pile said he needs to know what the DOE is going to do with his property. He cannot sell it, and the contamination in it prevents full use of the property. (29)

Response.

The design for Alternative 2, stabilization in place, in this FEIS differs from the Alternative-2 design in the DEIS in that the 5.4-acre industrial strip on the southwest corner of the Vitro site would not be part of the stabilization area. In other words, properties in the 5.4-acre strip would not be affected by the actions in this FEIS; however, they might be affected by the actions proposed for cleanup of vicinity properties. Thus, neither in that alternative nor in alternative 3, removal to South Clive, would this business be condemned or have to move. Regardless, in either case, it is a vicinity property. The owner of the property in question should consult with the Utah Department of Health concerning the effect on his land and business of being a vicinity property.

6.5 ALTERNATIVES

Many comments (in 5 written and 14 oral statements) were made on the alternatives analyzed in the DEIS. These covered a number of issues as identified below. The DOE's response to each of these comments follows the description of that issue. Suggestions for alternative designs are discussed in Section 6.9, Comment 8.

1. Comment.

Almost everyone who wrote or spoke had his or her opinion about what should be the preferred alternative. Few were neutral. Almost invariably Tooele County residents wanted the tailings left where they are and Salt Lake County residents wanted the tailings moved away. The Governor of Utah, the CVWRF Board, and many local boards and agencies in the valley are for moving the tailings. Tooele County boards and agencies prefer them to be left in place, or at least not moved to the South Clive site.

Response.

The DOE does care about local preferences among alternatives. These do not, however, change the technical facts that constitute one set of inputs to its choice. Rather, these preferences are all-important in forming the political input to its choice, have been considered in selecting the stated preference for removal in this FEIS, and will be reflected in the final record of decision on what to do about the Vitro tailings. Personal preferences are discussed further in Section 6.20.1.

2. Comment.

The State of Utah said that the DOE has vacillated in its preference among the alternatives. Early talk (and the CVWRF Board had understood this talk to be a promise) was in terms of moving the tailings, and the 1981 Remedial Action Concept Paper (RACP) expressed this opinion; however, the 1982 RACP proposed stabilizing the tailings in place. The DEIS expresses no preference. The early talk was purely in terms of what was needed for the health and safety of the people of Salt Lake County; only in 1982 was cost brought up as an important factor. (1, 18, 21, 38, 48, 107, 209, 211, 212)

Response.

There is merit in this comment. The first draft of the Remedial Action Concept Paper (RACP) for the Vitro site said, ". . . it appears that Option 2B, Disposal in the First Alternate Area, is the economically and environmentally preferable action." However, even then, that expression was qualified by the state- ment: "This (proposal of an action) does not imply a final selection of that option or less study or consideration of other options." There were few data or studies at that time that could technically support a definite preference for a stabilization in place alternative and--until further study might justify a change--the DOE made a tentative expression of preference for alternatives involving transfer of the wastes to a new location.

Studies to determine feasibility of stabilization in place were begun in early 1982. As the information developed in these studies became available, it became clear that stabilization in place would be technically feasible, could be accomplished in a way that would meet the proposed EPA standards, and would cost less than alternatives involving transport to new sites recommended by the state. The new information caused the DOE to shift its preferences, as expressed in the next-to-last draft of the RACP, to the stabilization in place option. At this point, the State of Utah objected to any expression of preference and suggested that the following language be inserted in the final draft of the RACP:

"A proposed option for the Vitro site remedial actions has not been selected by the cooperating parties, the DOE and the State of Utah. Accordingly, Options 2 and 3 will be given equal depth of study in the draft environmental impact statement (DEIS) covering the proposed remedial actions. The information supplied in the DEIS plus additional data and analyses to be published in 1982 will be used by the cooperating parties to reach agreement on the proposed course of action in the final EIS. Important considerations in deciding upon a proposed option will be: whether the options meet the EPA standards, the degree to which each option protects the environment and reduces health risks, the relative cost-benefit ratios of the options, and the impacts of each option on land use, social factors, and the physical environment (DOE, 1982a)."

The DEIS did not identify a preferred alternative. This FEIS does identify a preferred alternative: the removal of the Vitro tailings to South Clive.

3. Comment.

There were some comments to the effect that the site selection and alternative selection process omitted alternative sites that should have been examined.

The Department of the Interior and others suggested looking into the possibility of disposing of the tailings at existing mine waste dumps, other possible sites including Moab and Monticello, and "taking them back to where they came from." (3, 4, 11, 13, 41, 42, 47, 50, 102, 203)

Response.

Prior to initiation of this FEIS, the DOE investigated the feasibility of disposing of the tailings at 15 sites (including those described in Appendixes B and C and the referenced mine waste dump). The DOE investigation ranked the suitability of each site based upon geological, hydrological, ecological, and economic factors. The three eastern sites were ranked 1 through 3; the waste dump was ranked fourteenth. Relocating the tailings to Moab, Monticello, or returning the tailings to the uranium-ore mines would be unreasonable alternatives for the same reasons as those given in Appendix C.

4. Comment.

Several sets of comments included some discussion of reprocessing as an alternative.

o Comment a

The Department of the Interior pointed out that the studies reported in the DEIS considered reprocessing the tailings at a new process plant. The commenter thought that other processing options should be examined, such as in an existing uranium mill. (203)

o Response a

Reprocessing the Vitro tailings at an existing uranium mill would not be economically practicable. The tailings would have to be shipped to the nearest mill in eastern Utah at a cost in excess of the \$20 million in marketable value of the U_3O_8 , V_2O_5 , and Mo that could be extracted from the tailings, and of which the Federal government would receive only a part to offset its costs. After reprocessing, the residues would still be the responsibility of the DOE since most of the radioactive elements would remain; these residues would have to be stabilized at a new site in a manner that meets EPA standards within the time limits set by PL95-604.

o Comment b

An engineer in private practice suggested that "there are many other marketable products (in the tailings besides uranium, vanadium, and molybdenum) that can be concentrated from the tailings." He went on to suggest using flotation and bacterial leach treatment, saying that after such processing the remaining material could be left in place. (35, 108)

o Response b

Other than (possibly) uranium, vanadium, and molybdenum, there are no economic minerals in the Vitro tailings that could be extracted and marketed at a net profit using currently available technology. Because of the currently depressed market, even the economic minerals that remain in the tailings, and for which the ore was originally mined, are not marketable at a profit. Flotation and bacterial leaches would not remove all these materials from the tailings.

o Comment c

On the other hand, a state official said that "reprocessed residue tailings would remain with a high concentration of radium and other heavy metals that would result in the tailings still being classified as a radioactive hazardous waste." (211)

o Response c

Agreed: the tailings residues would still require stabilization under the provisions of PL95-604.

- o Comment d
A private citizen felt that a cost effectiveness study should be done to find out what part of the tailings can be processed to concentrate them so that they might be useful. (12)
- o Response d
The DOE believes that such a study has been done; it is summarized in Section C.4, Appendix C, of this FEIS. A full report of the study's findings is available (DOE 1982b).
- o Comment e
Another private citizen referred to an article in the Proceedings of the 15th Annual Uranium Seminar, held in Albuquerque on September 20-23, 1981, which described "a novel approach to tailings disposal." He didn't say what this process is but said it should be looked into. (5)
- o Response e
The referenced article was inaccurate because the referenced meeting was not held. The "novel approach" cannot be addressed without additional information. The DOE, through its UMTRA Project, has identified and reviewed currently available methods for tailings disposal.

6.6 THE GEOLOGIC AND HYDROLOGIC SUITABILITY OF THE VITRO SITE.

There were 16 written statements and 8 oral ones that commented on the suitability of the Vitro site for stabilization of the tailings in place. The issues involved were numerous; they are listed below together with the DOE's responses to each.

1. Comment.

The data base on which the analyses rely is inadequate. In particular, the hydrologic data are incomplete and the new studies planned are too short in duration to show seasonal or cyclic effects. Six to eight weeks is "far too brief to provide the necessary data on seasonal or cyclic changes." (6, 18, 19, 23, 39, 51, 107, 110, 202, 204, 209, 212)

Response.

The DOE believes that the additional hydrologic studies completed since publication of the DEIS and described in Appendix D of this FEIS are sufficient to characterize seasonal changes.

2. Comment.

Many private citizens, the State Health Department, the CVWRF Board, and others spoke or wrote about ground-water problems.

- Comment a
Ground-water contamination is probable or inevitable, regardless of design features intended to make it improbable. The need for public use of deep ground water may, some said, eventually reverse the present upward gradient of hydraulic head. (15, 18, 19, 39, 51, 105, 106, 107, 110, 202, 203, 204, 206, 207, 209, 211, 212)
- Response a
This subissue is addressed in Appendix D, and in Section 5.4 of this FEIS.
- Comment b
The City of South Salt Lake is considering the use of a well in the southeast corner of the site for general use. This would not be possible if the tailings remained at the Vitro site. (15, 203, 204)
- Response b
It is agreed that implementation of Alternative 2 of this FEIS would preclude well development in the location indicated by the commenters.
- Comment c
What is the source of the gross alpha, Ra-226, Ra-228, and U in the water samples from deep wells? What is the source of the heavy metals in the shallower wells (Tables D4, D5, D6)? Are contaminants present upgradient, as well as downgradient? (203, 204, 209)
- Response c
Activities of gross alpha, Ra-226, Ra-228 and U in samples taken from deep wells are background levels and probably are not associated with the Vitro mill tailings. A comparison of samples from wells 1, 2, and 3, representing background, confined ground water with samples from wells V-AD, V-BD, V-CD, V-DD, and V-FD, representing confined ground water beneath the site and samples from wells 4 and 5, representing downgradient, confined ground water, suggests that the tailings pile has not contributed radioactivity to the confined ground water. No samples from monitoring wells beneath or downgradient of the pile showed Ra-228, gross alpha, or U above background levels. Analyses of samples from two wells beneath the site, V-BD and V-ED indicated Ra-226 levels above background. A sample from well V-BD had a Ra-226 activity of 9.1 pCi/l. A second sample from the same well measured activity of <1.0 pCi/l. A sample from well V-ED measured Ra-226 activity of 4.5 pCi/l. This value is well within the range of background activity given possible sampling and analytic errors.

The area encompassing the Vitro site is urban and industrial. There are many potential sources of heavy metals to the shallow ground-water system. The Vitro mill tailings probably contribute U and Fe and possibly Mo to the shallow ground water. The source of any other heavy metals is not known but probably is not associated with the mill tailings pile.

There is upgradient as well as downgradient contamination of the shallow ground water. The upgradient contamination probably is not associated with the Vitro mill tailings but associated with other sources in the urban/industrial area surrounding the Vitro site. For example, a sample from upgradient well 6C showed higher Cl than any samples from any downgradient well. This well is adjacent to Interstate 15. The sample was taken in the spring of 1983. It is likely the measured contamination was from infiltration of snow and rain containing road salts.

- o Comment d
The treatment of contaminant mobility is inadequate, as a variety of environments--acidic, neutral, and basic--are likely to be encountered at different locations in the system. (203, 204)
- o Response d
This issue has been addressed in Appendix D of this FEIS.
- o Comment e
On the other hand, one private citizen stated that pollution from the mill tailings is not a particularly serious problem. Heavy usage of the deep ground water would "render it polluted by sewage, filthy run-off water, road tar extracts and so on." (111)
- o Response e
Contamination of the confined aquifer by sewage and urban runoff is an issue beyond the scope of the FEIS. The contamination of the confined aquifer by brackish water in the unconfined system as a result of heavy pumping of the confined aquifer during mill operation is discussed in Appendix D of this FEIS.

3. Comment.

The State Health Department, the EPA, and others wrote or spoke about shallow water problems.

- o Comment a
The DEIS states that "the ground- and surface-water systems involved do not contain potable water." This is wrong; there are now 41 wells within one-half mile of the site drawing household water from the shallow aquifer. It is only a matter of time before the surface-water system is contaminated. (1, 18, 110, 202, 203, 204, 209, 212)

- o Response a
This statement does not appear in the DEIS without qualification. The on-site surface waters are certainly not potable according to Utah standards for domestic sources of water; neither are the ground waters in the unconfined aquifer at 2- to 45-ft depths below the site (see Appendix D). Regarding the "41 wells within one-half mile of the site": Data on these wells were requested from the Salt Lake City-County Health Department on March 31, 1983 (letter from Kelly M. Peil, Jacobs/ Weston Team, to City-County Health Department). The Health Department replied that "A search was made of our records with no chemical data found on any wells in that area. At the time those wells were drilled, no chemical information was required in this office." (letter from Jewel Snow, Bureau of Water Quality, to Kelly M. Peil, Jacobs/Weston Team, April 19, 1983.) A review of U.S. Geological Survey records indicated the existence of 2 wells, possibly within one-half mile of the Vitro site. The majority of the wells referenced by the state were at depths greater than 60 feet. These wells are in the artesian aquifer, not the shallow aquifer. The two wells identified by the USGS are upgradient of, and unaffected by, the Vitro site. Possible effects on wells within one-half mile of the site are discussed in Section 5.4.2 of this FEIS.
- o Comment b
Water-table depths are misleading, as they are based on just one season's observations. Other work has indicated a much broader fluctuation in water-table depth. Also, ground-water flow is toward the Jordan River and Mill Creek; a strong potential thus exists for migration of contaminants from the site to nearby surface waters. (209, 212)
- o Response b
It is agreed that fluctuations in the water-table depths could be wider than those indicated by DOE measurements; the important item is the consequence of foreseeable wide fluctuations in water-table depths; some of these consequences are discussed in Appendix D, and Section 5.4.2 of this FEIS. It was recognized in the DEIS that "groundwater flow (in the unconfined system) is toward the Jordan River and Mill Creek . . .", and that a potential exists for migration of contaminants to these water bodies.

4. Comment.

The Vitro site is in an identified flood drainage basin with known general flooding from nearby drainage canals. The possibility of dam breaks has not been considered. Probable Maximum Flood (PMF) flows at the site would create an erosion hazard. (110, 214)

Response.

These effects are addressed both in the DEIS and in this FEIS in Subsection 5.3.4; see also the response to Issue 1 in Section 6.9.

5. Comment.

The State Health Department, the CVWRF Board, and others doubt the ability of the underlying soil to support the tailings either in the short or the long term.

o Comment a

The soil will have little bearing strength unless it is precompacted by covering the site with a large mound of earth for at least three years. Otherwise uneven settling will cause the liner and cover to fail. There is also the possibility of mud waves (permanent ridges surrounding the site caused by underlying soil moving laterally out from under the pile), and there may be interference with normal ground-water flows in the area causing unpredicted surface and subsurface characteristics. (1, 15, 204, 206, 207, 209)

o Response a

The potential does exist for the development of areal settlements (analyses indicate approximately 2 inches) immediately adjacent to the stabilized mound. Thus, it may be necessary to offset the mound a "safe" distance from the adjacent roadways and critical utility lines. This could require some slight modifications to the location and general configuration of the stabilized area as is shown on Figure A-16 of the DEIS and updated in Appendix A of this FEIS. However, these modifications should have essentially no effect upon the feasibility of the conceptual scheme.

Analyses to date indicate that the majority of the settlement associated with the construction of the stabilized mound would occur during the three-year period predicted for the required earthwork operations. Thus, "long-term" settlement which could affect the integrity of any future facility should not be a problem.

It is recognized that there are "margins of error" or "risks" associated with these analyses and that with additional field and laboratory analysis these "margins of error" or "risks" could be reduced. The State of Utah has indicated that differential settlement may indeed be more of a concern than indicated by the engineering analyses included in this EIS. If preloading were to be required, based upon engineering analyses and cost estimates prepared by the state, an additional 3.0 million cy of fill would be needed for about 2.5 years to preload the site prior to tailings placement (letter from State of Utah Department of Transportation to the Department of Health, December 19, 1983).

Preloading would result in an increase in short-term impacts beyond those identified in the EIS. Increases would occur primarily in traffic, combustion and particulate emissions, noise, and soil requirements. Employment (and economic factors) would be relatively similar in magnitude although impacts would occur over a longer time span.

o Comment b

The statement on page A-35 ". . if a liquefaction incident were to occur in one of the discontinuous soil layers little evidence of liquefaction would be apparent and damage to the site would not be expected . . ." is inaccurate. (209, 214)

o Response b

The quoted statement was based upon the results of preliminary field investigations which indicated only isolated, discontinuous zones of potentially liquifiable soils. Due to the minimal topographic relief within the site area, it is DOE's opinion that the liquefaction of these zones would not induce any significant lateral displacements which could have the potential to damage the subbase or protective cover. Further, the areal settlement resulting from the densification of these zones should be minimal.

6.7 THE GEOLOGIC AND HYDROLOGIC SUITABILITY OF THE SOUTH CLIVE SITE

There were 3 written statements and 5 oral ones that commented on the suitability of the South Clive site for final disposition of the tailings. The issues brought up are outlined below together with the DOE's responses to these concerns.

1. Comment.

Several persons, including a representative of Tooele County, said that the data base on which the analysis of the site was made is inadequate. No weather data were taken at the site; instead the weather was inferred from records taken at stations many miles away. Nothing is known about the deep underlying geology. There are a number of ranches in the area not mentioned in the DEIS. (6, 11, 14, 209)

Response.

Before gathering the data that support this FEIS, DOE contractors reviewed Utah and NRC requirements that are applicable to air quality and meteorology. This review included discussions with the Utah State Health Department Bureau of Air Quality and the NRC. The Bureau of Air Quality agreed to the use of existing Salt Lake City meteorological information for the Vitro site and the use of Wendover Air Force Base meteorological data for the South Clive site. Regarding the deep, underlying geology of the South Clive site, it is known that the unconsolidated Quaternary deposits below the site are at least 500 feet thick. The properties of this layer

alone would thus determine the suitability of the South Clive area for uranium mill tailings disposal. Regarding ranches not mentioned in the DEIS: the DOE surveys in 1980 identified no permanent residences within 15 miles of the site; to the DOE's knowledge, no new residences have since been established.

2. Comment.

Several commenters stated that the site is hydrologically unsuitable. The DEIS says the depth to water varies from 20 to 35 feet; but during the time the hearings were being held, water was standing on the surface and this happens every year at this time. Also, long-term climatic variations, such as have occurred in the last 1000 years, might substantially raise the water table. (6, 214)

Response.

The surficial materials underlying the South Clive site consist of a three- to twelve-foot surface layer of sandy to clayey silt over lacustrine sands and silty clays. Because of the low permeability of the surface materials, ponding and the occurrence of standing water seasonally are expected. The ponding is due to surface runoff and is not a surface representation of the water table.

As described in Appendix A to the DEIS, and Appendix D of the FEIS, the depth to the ground water as observed in both cased monitoring wells and in open boreholes drilled during the geotechnical program at the South Clive site ranged from 20 feet in boring number SC-2 to more than 30 feet in boreholes SC-4, SC-9, and SC-10. Fluctuations in the depth to the water table in all monitoring wells and open boreholes were small, ranging from 0.3 feet in boreholes SC-6 and SC-13 to 2.9 feet in borehole SC-1. Boreholes SC-1, SC-6, and SC-13 were monitored over nine, five, and two months, respectively. The water levels in these wells were monitored by the state of Utah in 1983 and were found to be the same as reported in the DEIS.

It is agreed that long-term climatic variations, although unpredictable, might cause a substantial rise in the water table. The effect of such a rise on the stabilized tailings is unknown.

3. Comment.

The inevitable contamination of the ground water at the South Clive site will affect drinking water supplies at Tooele, Grantsville, and Cloverdale. (4)

Response.

The South Clive site is located in an area of regional ground-water discharge. As a result, the primary direction of flow is upward and toward the playas to the west of the site. The potential for any direct impact on drinking water supplies at Tooele, Grantsville, or Cloverdale is extremely remote. Further, analyses of the ground-water samples from the monitoring wells completed on the South Clive site indicate that the water does not meet either State of Utah or U.S. EPA primary and secondary drinking water standards

and is not suitable for domestic use without extensive treatment. For instance, total dissolved solids concentrations range from about 20,000 to more than 45,000 mg/l compared to the U.S. EPA secondary drinking water standard of 500 mg/l. The water is very high in sodium, chloride, sulfate, strontium, and other dissolved salts.

4. Comment.

A 100-year flood would wash the tailings away, if they are disposed of at South Clive. The absence of dry washes is not evidence against this possibility, because such washes are filled up again between these extreme events. (12)

Response.

This subissue was addressed in the DEIS and is addressed in this FEIS in Subsection 5.3.4 of the main text. In summary, analysis of a Probable Maximum Flood (a storm event far in excess of a 100-year flood) indicate that the erosion barrier will protect the disposal site.

5. Comment.

A group pointed out that the local hydraulic gradient is to the northeast, which may imply that the local shallow water is not supplied by recharge at the foot of the Cedar Mountains to the east. They inferred from this that seepage from the site, if unchecked, would cause a ground-water mound to form at the mountains, resulting in an undesirable change in the ground-water flow regime with a consequent rise of the water table at the site. (110)

Response.

The cause of the northeasterly hydraulic gradient in the unconfined aquifer at South Clive is unknown. However, even if the disposal site were to be a 200-acre lake instead of relatively dry materials, there is no possibility that it could "cause a ground-water mound to form at the mountains" more than 3 miles away to the northeast. The natural sources of recharge of the shallow aquifer would utterly dominate the small contribution from site seepage in determining changes in the ground-water/flow regime.

6. Comment.

A Utah state geologist said evapotranspiration is unlikely with the water table at a depth of 25 to 35 feet. (214)

Response

The DOE agrees that evapotranspiration from the water table is not likely. However, evapotranspiration is an important process in the fate of local rainwater, some of which is transpired by the thin cover of vegetation.

7. Comment.

An advantage of the South Clive site is the local availability of cover material. (110)

Response.

Agreed.

6.8 THE SEISMIC SUITABILITY OF THE VITRO AND SOUTH CLIVE SITES

There were 6 written statements and 6 oral ones that commented on the seismic suitability of the Vitro site for the stabilization of the tailings in place or the South Clive site for final disposition of the tailings. The issues brought up are outlined below together with the DOE's responses to these concerns.

1. Comment.

The seismic data bases for both the Vitro and South Clive sites are inadequate. There have been no serious seismic studies. (1, 6, 206, 212)

Response.

Seismic analyses have been performed and the results included in this FEIS as Appendix H. The analyses of impacts of seismic events in Subsection 5.3.4 have been amplified.

2. Comment.

A seismic event near the Vitro site, probable because of the nearness of the Wasatch fault, could damage the tailings pile, the proposed liner, and the ground-water regime at that site. Increased seepage could then result in contamination of the ground water; the State Health Department envisions a possible "direct pathway from the tailings to the ground water." (1, 15, 20, 206, 207, 211)

Response.

The issue of seismic damage to the tailings pile through slope failure is addressed in Appendix H, and is summarized in Section 5.3.4 of the text. The DOE agrees that liner system failure could occur during extreme seismic events (Maximum Credible Earthquake, 1000-2000 years return period) in which liquefaction of underlying sand lenses would induce differential movement of the liner system and embankment (a few inches). It is also agreed that extreme seismic events could change the ground-water regime at the site; but such changes would result in insignificant contamination of ground water from the tailings pile because of the design and existing water quality. (See Appendix D.3.2 for water-quality data).

3. Comment.

The locations of three earthquakes are incorrectly given. The governor said, "Serious miscalculations render the seismic analysis invalid." (209, 214)

Response.

This issue arises from the following comment regarding material on page 58 and in Table 4-1 of the DEIS:

The May 22, 1910 earthquake was probably at about 40°44.94' and 111°50.95', well south of Bountiful and about 5 km from the Vitro site. It had an estimated magnitude of 5.7. The November 10, 1884, earthquake was not in Bountiful, but near the Utah-Idaho border. The March 28, 1975, event was at Pocatello Valley, not Pocatello, Idaho. Damage reports clearly indicate that the December 1, 1958, earthquake was near Nephi. The errors in pinpointing the locations of the latter three events is around 100 km. These gross errors negate the validity of the seismic risk analysis.

The May 22, 1910, earthquake is listed in "Earthquake History of the United States" (Coffman and von Hake, 1973; NOAA, 1982a) as having its epicenter located at 40.8 degrees north latitude and 111.9 degrees west longitude, which is slightly more than 6 miles (9.7 kilometers) north of the Vitro site and about 7 miles (11.3 km) south of downtown Bountiful. The epicenter location is in the extreme northwest part of Salt Lake City.

The location and distance from the Vitro site of the epicenter for the November 10, 1884, earthquake was taken from the NOAA (1982a) computerized "Earthquake Data File." This listing is in error. The true epicenter location is near the Utah-Idaho border in Bear Lake Valley, about 95 miles north of Salt Lake City.

The word "Valley" was inadvertently left out of the location for the March 28, 1975, earthquake.

Again, the "Earthquake Data File" (NOAA, 1982a) lists the earthquake of December 1, 1958, as having its epicenter at 40.5 degrees north latitude and 112.5 degrees west longitude on the west side of the Tooele Army Depot. Cook and Smith (1967) also list this event as having its epicenter located in the St. John area, which is near the location listed by NOAA. Both of these locations are situated approximately 55 to 60 miles northwest of Nephi.

The historical seismic record is used to define regional seismicity as one portion of preparation of the input for a probabilistic seismic risk study. The model makes no direct use of any single historic event and, because of restraints in the development of the input parameter, the possible mislocation of a single event will have almost no influence on the results of the analysis.

4. Comment.

The Utah Geological and Mineral Survey believes that most of the earthquakes in Utah cannot be correlated with surface faults. They ask what reference indicates that "more than 90 percent of the earthquakes which occurred in Utah between 1950 and 1965 were located along or in association with known fault zones?" (209, 214)

Response.

It is agreed that the previous cited interpretation by Cook in 1970 is misleading. It is also true that if the total seismic record is considered, both small and large magnitude events, most earthquakes in Utah cannot be correlated with surface faults. It must be noted, however, that for most large, damaging earthquakes in the Basin and Range Province, such as the MCE considered for the Vitro site, it is common and predictable that surface faulting will result. It is also reasonable to conclude that it is common for this surface rupture to occur along fault systems which express geomorphic features of past, geologically young activity, such as the Wasatch frontal fault system.

5. Comment.

The EPA, the Governor, and the Utah Geological and Mineral Survey wrote about acceleration values.

o Comment a

The 21 percent estimate for horizontal bedrock acceleration is invalid because the Vitro site is not located on rock. (209, 214)

o Response a

The horizontal bedrock acceleration of 23 percent g (not 21 percent g) was based on a 90 percent chance of nonexceedance in 50 years at the Vitro site; it was calculated that the presence of deep, saturated alluvium between the site and bedrock would reduce this acceleration slightly, to about 20 percent g (see page 116, 4th paragraph, of the DEIS). Seed and others (1976) found that peak accelerations between 0.1 and 0.7 g at sites where rock is exposed at the ground surface tend to exceed peak accelerations at the ground surface where sites are underlain by more than 80 meters of soil. This is consistent with the recommendation presented on page 116, to utilize a design acceleration of 0.2 g for the Vitro site.

o Comment b

The 50-year standard for horizontal bedrock acceleration is used for construction purposes but is not applicable to the Vitro disposal configuration. A more reasonable approach for the Vitro site is the use of the 250-year, 90 percent probability standard. "For bedrock the value would be 60 percent g." (209, 214)

o Response b

The 50-year standard for horizontal acceleration (i.e., 90 percent probability of not exceeding 20 percent g in 50 years) was used in the DEIS for the conceptual design for Alternative 2 because it was believed that the stabilized pile would not be classified as a "critical" structure, such as a hospital, archives, or any other structure in which extreme seismic events could cause loss of life or damage to irreplaceable resources. It is possible that interpretations of final EPA Standards may require a design that meets the 250-year, 90 percent probability of nonexceedance of approximately 40 percent g; the implications of this are discussed in Appendix H of this FEIS.

- Comment c
The EPA questioned the maximum seismic acceleration being 0.2g at both the Vitro and South Clive sites. Since the Vitro site is much closer to an active fault, this appears unreasonable. (204)
- Response c
Since publication of the DEIS, detailed seismicity studies have been completed and are included in Appendix H. These studies have found that the front of the Wasatch Range is apparently a still-active normal fault. Motion on it or its tributary faults could produce accelerations in rock of as much as 0.3 g to 0.55 g at the Vitro site. The South clive site is also located in a region which contains active faulting; however, maximum expected accelerations in bedrock would approximate 0.37 g.
- Comment d
The USGS assigns a value for the Wasatch Front for horizontal bedrock acceleration with a 90 percent probability of not being exceeded in 50 years of 27 percent g. (214)
- Response d
Algermissen and others (1982) have developed horizontal acceleration estimates in rock with a 90 percent probability of not being exceeded in 10, 50, and 250 years. Their estimates are 0.09, 0.22, and 0.55 percent of gravity, respectively, for the Salt Lake City area. The average return period for these accelerations are 232, 475 and 2,372 years, respectively.

The use of different design earthquakes for different types of facilities has been actively discouraged (Newmark and Hall, 1973). Instead, higher factors of safety should be used for more critical facilities.

The actual level of acceleration for the Vitro site should not be a major issue. Seed (1979) showed that well-engineered earth embankments designed using a lateral force coefficient of 0.10 to 0.15 are readily able to safely withstand ground motions that are produced in the near-field region of a magnitude 7 to 7.5 earthquake.

6. Comment.
The Governor and the Utah Geological and Mineral Survey wrote about earthquake magnitudes and ground response.

- Comment a
A statement is not true that refers to earthquakes in Nevada and Wyoming, "Each of these earthquakes was of a magnitude comparable with what might be expected to be the maximum event produced by the faulting along the front of the Wasatch Range." (209, 214)
- Response a
This issue has been reevaluated and is discussed in Sections 4.5.4, 5.3.4, and Appendix H.
- Comment b
A critical structure such as that proposed for the Vitro site should anticipate a magnitude 7.5 event occurring in the Salt Lake Valley. (209, 214)
- Response b
In Appendix H of this FEIS, it is concluded that there is a reasonable possibility of a magnitude 7.0 or greater earthquake occurring along the Wasatch Front within the next 200 years. The consequences of such an earthquake for the integrity of the tailings-disposal structure proposed in Alternative 2 are also discussed in Appendix H and Section 5.3.4.
- Comment c
Ground responses at sites on thick saturated alluvium such as exists beneath large parts of the Salt Lake City area can be ten times greater than at adjacent rock sites. (209, 214)
- Response c
The "ground responses" are acceleration, speed, and displacement. In thick, saturated alluvium horizontal accelerations are likely to be slightly attenuated relative to adjacent locations on bedrock; on the other hand, displacements could be amplified relative to bedrock sites. Horizontal accelerations are the main cause of slope failure.

7. Comment.

A private citizen, in reference to discussion of seismic activity of the Wasatch Fault during recent time, said, "This recent activity has been happening for the last ten thousand years. Okay? It hasn't been. . . recent as in twenty years." (5)

Response.

To geologists, "recent" means the Recent (Holocene) epoch, the 7 to 12 thousand-year period of time since the last ice age ended in North America.

8. Comment.

Another private citizen felt that if the site is seismically suitable for buildings and sewage plants, then it should also be suitable for stabilization in place of the mill tailings. (26)

Response.

See paragraphs b and d of the response to Issue 5.

6.9 ENGINEERING DESIGNS

There were 16 written and 21 oral statements that commented on various aspects of the engineering designs for the two action alternatives. These are summarized below, together with the DOE's responses to these comments.

1. Comment.

Several comments focused on the design of Alternative 2, stabilization in place.

o Comment a

The design for stabilization in place at the Vitro site makes no allowance for soil settling under the pile and for consequent failure of the liner, damage to roads, and disruption of utilities. (19, 209, 212)

o Response a

The engineers who drafted the conceptual design for Alternative 2 calculate that up to 2.7 ft of soil settling under the center of the pile could be expected. Since the pile would be constructed in segments over a 2.5-year period, adjustments for differential settling of the liners under each segment could easily be made. There would be no damage of roads or disruption of utilities (the latter would be rerouted around the pile). Calculated settlements at the edge of the pile will only be on the order of 2 inches.

o Comment b

The governor and others pointed out that the DOE has made no commitment to a liner, but that since the tailings are now in contact with ground water, a liner is definitely needed. (6, 18, 202, 204, 209, 212)

o Response b

See the responses to Issues 4 and 5 in this section.

o Comment c

"Dam failure should be considered. If this factor is added to a probable maximum flood in progress, floodwater velocities could reach seven (7) feet per second, thereby creating an erosion hazard." (214)

o Response c

The two existing major structures whose failure may result in flooding conditions in the Jordan River Basin are the Deer Creek Reservoir on the Provo River and the outlet gates on Utah Lake at the headwaters of the Jordan River. Salient features of these two surface water bodies are given below:

Name	Stream	Approx. Location	Height (ft)	Storage Capacity (ac-ft)	Surface Area (acres)
Deer Creek Reservoir	Provo River	25 miles up- stream of Utah Lake	150	161,000	---
Utah Lake	Jordan River	Headwaters	18 ft at Lake el. 4494.0 13.34 ft at Lake el. 4489.34 ^a	1,369,894 898,000	107,538 95,000

^a 4489.34 ft is the compromise lake elevation at which the outlet gates are opened agreed upon by the affected landowners and water users.

In addition, two proposed reservoirs, the Lampton Reservoir and Jordanelle Reservoir, are at different stages of planning. The Lampton Reservoir is proposed to be located on the Jordan River at about 9800 South upstream of Salt Lake City and downstream (north) of Bluffdale with a storage capacity of 48,000 acre-ft, reservoir surface area of 2,310 acres, and maximum and mean water depths of 56 and 20.8 ft, respectively. According to the Dam Safety Branch of the Utah State, the probability of this dam being constructed is very low. The Jordanelle Reservoir is proposed to be located on the Provo River about ten miles upstream of the Deer Creek Reservoir, with a storage capacity of 325,000 acre-ft. According to current practice, the consequences of the failures of these proposed dams will be analyzed in detail well before the authorization of construction and the final designs of the respective dams will ensure that any significant adverse environmental impacts resulting from their failures are mitigated to acceptable levels. At the present time, the location, size, feasibility, and details of construction of these dams have not been finalized. Therefore, evaluation of the impacts of postulated dam-break scenarios for these nonexistent facilities is not considered necessary.

Based on analysis of similar dams (Fread, 1979), the floodwaters released by a complete breach in the Deer Creek Dam will be fully absorbed by the valley storage in the 25 mile-long floodplain of the Provo River between the dam and Utah Lake and will not result in a rise of more than 1.5 ft in the water surface elevation of Utah Lake. Therefore, it is concluded that the impact of the failure of Deer Creek Dam at the Vitro site, which is approximately 25 miles downstream from Utah Lake, will be insignificant.

A conservative estimate of the flood wave released by a complete failure of the outlet gates on Utah Lake indicates that the peak flow would be 128 cfs/ft on opening when the lake is at the maximum elevation of 4494.0 ft and 82 cfs/ft when the lake is at the compromise elevation of 4489.34 ft (US Army Corps of Engineers, 1977). Thus, a postulated opening of 100 ft, which is slightly more than the overall span of the outlet gates, will result in a peak flow of 12,800 cfs. This is only three percent of the PMF peak and will be greatly attenuated by the valley storage between Utah Lake and the Vitro site. Therefore, even if the occurrence of the PMF peak on the Jordan River coincides with the peak of the dam-break flood wave, the flow velocities and erosion potential at the Vitro site will be nearly the same as those for the PMF conditions alone. It must be emphasized that the above-mentioned coincidence is an event of extremely low probability. The outlet gates at Utah Lake would most likely be destroyed by the flood flows preceeding the PMF peak and the peak of the resulting dam-break flood wave would pass the Vitro site well before the PMF peak.

Regardless, the embankment as designed will withstand 14 fps without loss of the erosion barrier. Appendix A contains the details of this analysis.

2. Comment.

Several comments focused on the design proposed for Alternative 3.

- o Comment a
Burial at South Clive would not be deep enough. At Los Alamos, low-level waste is buried 40 feet deep. (11)
- o Response a
The low-level radioactive waste produced by Los Alamos National Laboratory is occasionally much "hotter" (i.e., greater specific activity than uranium mill tailings) and contains more mobile contaminants, such as tritium. These wastes warrant deeper burial, which is possible at Los Alamos because the water table under the Pajarito Plateau is several hundred feet below the surface. At the South Clive site ground water can be found within 25 to 35 feet of the surface, albeit of poor quality.
- o Comment b
Dewatering the site during construction will be necessary and should be considered. (6)
- o Response b
It is agreed that dewatering of the site will be necessary; this is included in the description for Alternative 3 in Appendix A and Section 3.2.4.
- o Comment c
A liner is needed to protect the ground water from contamination. (6, 110)

- o Response c
See responses to Issues 4 and 5 in this section.
- o Comment d
The DEIS says that the soils at the South Clive site are unsuitable for reestablishing a lasting, self-sustained vegetation. It also says that the local vegetation forms "an important ground cover and deterrent to soil erosion..." The DOE should clarify this apparent contradiction. (110)
- o Response d
The importance of the native vegetation's role in deterring soil erosion was perhaps overstated here. The relative flatness of the terrain is probably the major deterrent to soil erosion. Indeed, South Clive appears to be a depositional area (where soil is being deposited), rather than a degradational area (where soil is being removed). The South Clive soils are unsuitable for establishing a self-sustaining vegetation cover of any species but the native ones. A final cover layer of pit run rock will prevent erosion of the disposal embankment, without the need for a self-sustaining vegetative cover. Section A.6.2 has been revised to clarify this issue.
- o Comment e
On page 118, the statement "for transient loading conditions such as the ones imposed by earthquakes, acceptable factors of safety range from 1.0 to 1.3 is incorrect and in conflict with page A-69 which indicates that a factor of safety "well in excess of 1.5 is generally accepted as the recommended minimum to ensure stability." (209, 214)
- o Response e
In a review of pertinent geotechnical references and requirements set forth by regulatory agencies, the acceptable factors of safety for transient loading conditions, such as those imposed by earthquakes, appear to vary between 1.0 and 1.3. The most pertinent reference is that cited by the Nuclear Regulatory Commission in which a minimum seismic factor of safety of 1.0 is recommended for the design of uranium tailings disposal facilities. An additional pertinent reference is that cited by the US Mine Safety and Health Administration (MSHA) for the design of mine-related embankment systems. For these facilities a minimum seismic factor of safety of 1.2 is recommended.

The above statement is not in conflict with page A-69 (of the DEIS) which indicates that a minimum factor of safety of 1.5, "is generally accepted as the recommended minimum to ensure stability." This latter statement is in reference to the overall stability of the slopes associated with the excavation at South Clive. The quoted factor of safety pertains to sustained or static loading conditions and does not consider the potential application of seismic loads.

3. Comment.

Salt Lake County would not have permitted a sanitary landfill to be constructed at a site with as shallow groundwater as the Vitro site or with as inadequate and uncertain a design as this. There is no commitment to a liner (and even then uncertainty as to its effectiveness) and no slurry wall surrounding the site. A sanitary landfill in the valley would be required to have a leachate control system; none is provided for in this design. (1, 15, 23)

Response.

The implications of this issue are that the engineering difficulties and hazards associated with a landfill are significantly less than those of a tailings disposal site. This is not necessarily true. For example, a landfill is particularly sensitive to settlement and leachate production because of the highly porous nature of the fill; this is not so for a stabilized pile. Regarding "a leachate control system," none was included in the design because it would require active maintenance which is contrary to EPA standards. These systems typically require an underdrain to collect leachate that flows to a sump; leachate is then pumped from beneath the source (i.e., pile) for treatment and discharge. Further, the design and ground-water analyses indicate that such a system would not be needed because of the very long time period (700+ years) before contaminants would reach the ground water in low concentrations. (see Appendixes A and D).

4. Comment.

There was some discussion about liners and slurry walls, mostly doubting their efficacy and longevity.

o Comment a

A few officials said that if a liner is not used at the Vitro site, presumably a slurry wall would be; however, the efficacy of a slurry wall depends upon maintenance of an upward hydraulic gradient. (18, 202, 204)

o Response a

The DOE has made a commitment to use a liner system in the design of Alternative 2 of this FEIS. Although a moot point, the fact that "the efficacy of a slurry wall depends upon maintenance of an upward hydraulic gradient" was stated in the DEIS; Subsection 5.4.3.

o Comment b

Still and all, liners have not been tested enough with "materials of untested quality such as the Vitro tailings." (209, 212)

o Response b

The DOE agrees that before using any material in a liner system, studies would have to be performed to determine the chemical and physical compatibility of available liner materials with the tailings.

- Comment c
A liner cannot guarantee the integrity of the aquifers in perpetuity. (107, 211)
- Response c
Agreed. However, worst-case analyses (Appendix D) indicate that arsenic, uranium, and molybdenum would cross the liner system in very low concentrations in 700+ years.
- Comment d
One citizen felt that "the proposal to underlay the tailings (option 2) with clay is ridiculous." Water will penetrate both the surface and basement layers of clay and will not filter out arsenic or other pollutants. (2)
- Response d
A liner system serves two purposes: 1) it retards water flow across it; and 2) by absorption it inhibits the transport of certain dissolved elements. Water flows less rapidly through a layer of clay than, say, a layer of sand in the presence of equal pressure heads; clay and rocks formed of clay (shales) are said to be relatively impermeable. In addition, some of the elements dissolved in the water are strongly adsorbed on the surface of the clay particles because of the enormous surface areas offered by the foliar clay granules. The net effect of a liner system is to greatly slow down the escape of contaminants from within the containment volume to adjacent soils. For example, dissolved arsenic is transported through typical clays at speeds that are 1/300 to 1/120 of the water speed.
- Comment e
The DEIS demonstrated the seepage attenuation properties of a clay liner for Ra-226 (Figures A-11, A-12, A-13). "Ra-226 is a notoriously slow mover. DOE should construct seepage migration models and graphics to compare the rate of migration of other more mobile contaminants...." (110)
- Response e
Agreed. See Appendix D of this FEIS.

5. Comment.

Many commenters discussed the longevity of the proposed disposal facilities.

- Comment a
There is a need for a permanent solution. The radiation hazard will last for thousands of years, and the hazard from heavy metals will last forever. "The remedial action must be done right the first time." Past mistakes should not be repeated. (1, 10, 12, 18, 23, 24, 105, 110, 202, 206, 207, 208, 209, 211, 212)

- Response a
The DOE believes that compliance of remedial actions with EPA standards, as mandated by PL95-604, will effect as "permanent" a solution as is reasonably achievable, given limited Federal resources and the magnitude of the problem relative to other national problems.
- Comment b
If the stabilization in place design is chosen, the liner will fail, either in the short term because of settling of the soil under it or in the long term because of seismic shock. (1, 15, 19, 28, 35, 107, 202, 206, 209, 212)
- Response b
Some of the consequences of liner system failure are discussed in Appendix D of this FEIS.
- Comment c
One of the design options for Alternative 3 (which calls for partial below-grade disposal, a 4-foot clay liner, a 6-foot cover including a 2-foot clay cap, and a riprap-lined diversion ditch) will provide protection for the recommended 1000 years. (110)
- Response c
It is agreed that the referenced design option would provide reasonable assurance of protection for the 1000-year period required by final EPA standards.
- Comment d
On the other hand, one citizen felt that concerns about longevity were unwarranted. "Due to our inexorable depletion of our resources, in several decades that pile will be a valuable mineral resource and will be mined for its mineral value." After this future reprocessing, the tailings would be disposed of in a proper permanent way. (111)
- Response d
The possibility that resources in the stabilized Vitro tailings might be retrieved in the future was mentioned in Section 5.17 of the DEIS.
- Comment e
A citizen with experience in these matters felt that reliability engineering was the appropriate method for determining the longevity of a proposed facility. (12)
- Response e
The techniques of modern reliability engineering are difficult to apply to problems in waste disposal because of the many uncertain elements in the system of waste-and-emplacement structures (it is in part a natural system, not entirely engineered), and because of the chronic nature of certain of the system's "failure modes" (failure statistics of components are not measurable in reasonable amounts of time).

6. Comment.

There were several comments about the cover to be used.

- o Comment a
More detail was asked for on the calculations made on the thickness of cover needed to protect the tailings from water, water erosion, and human disruption. (110)
- o Response a
Details regarding cover thickness are included in Appendix A of this FEIS. The pit run rock layer on the cover will prevent erosion from runoff or during the unlikely flooding events. The cover design will prevent inadvertent human intrusion.
- o Comment b
Sand, gravel, and clay are in short supply along the Wasatch Front. (209, 212, 214)
- o Response b
The sand, gravel, and clay needed to complete Alternatives 2 or 3 would be obtained from identified commercial suppliers or, in Alternative 3, would be taken from on-site excavations at South Clive. Based upon field investigations conducted by the DOE and discussions with commercial vendors, the amount of these materials used would not tax supplies available in the Salt Lake Valley or Tooele County.

7. Comment.

There were several comments about transporting the tailings from the Vitro to the South Clive site.

- o Comment a
One private citizen noted that the DEIS called for a railway car with "a solid covering on the top and if at all possible a solid floor." In the FEIS he would like to see "this type of container transport by rail and not by road be reaffirmed." (22)
- o Response a
Tailings transport by truck and railroad for relocation to South Clive is evaluated in Appendix A and elsewhere in this FEIS.
- o Comment b
One private citizen asked, "Where will the railroad cars go to be washed down and where will this dangerous, contaminated water and material go -- on the ground?" (4)
- o Response b
The railroad cars and haul trucks would be washed down at washdown stations before leaving either site. The washdown water would be confined and recycled from tanks or lined lagoons. Any excess washdown water would be used as tailings compaction water or treated prior to discharge.

- Comment c
Another citizen suggested that instead of moving the material by train or truck, the DOE "could slurry it out in the pipeline, a temporary pipeline." (50)
 - Response c
The DOE believes that moving the tailings to South Clive by slurry pipeline would be totally impracticable because of the uncertainty and costs of obtaining rights-of-way for such a pipeline, because the tailings would have to be dewatered at South Clive before they could be covered, and because of the additional cost to dispose of the pipeline.
8. Comment.
Several persons suggested variations in the design for Alternative 2. These are summarized below.
- Comment a
Reduce the pile to grade; cover with successive layers of bentonite clay, sewage sludge, and soil; plant with the desired vegetation. (40, 102)
 - Response a
Except for reducing the pile to grade and the use of sewage sludge, this suggested variation is essentially the same as Alternative 2. Reducing the pile to grade is assumed here to mean complete burial. Besides being unnecessarily expensive, this would bring almost all of the tailings into contact with ground water--a situation that the design of Alternative 2 avoids. The DOE sees no benefits in using sewage sludge as part of a cover (see paragraph 3, response to this issue).
 - Comment b
Compact the material to 95 percent of its ultimate density; place a membrane of flexible materials on the base and top of each mixed and compacted layer; cover the pile with a 9-inch concrete topping. (32)
 - Response b
The DOE assumes that the purpose of the interlayered flexible membranes would be to reduce settlement and damage from seismic events. In essence, Alternative 2 incorporates similar measures; tailings will be desaturated and compacted in lifts on a liner system, and will be covered with natural materials. The layers in the liner system and cover will be composed of materials that will "flex" under material stresses. Natural soils were selected as cover rather than concrete because concrete will weather more easily over time (a 1000-year longevity standard is difficult to demonstrate).

- Comment c
Relocate those tailings (if any) which are below the water table; dewater them; contour the pile to suit future users of the land; inject sewage sludge into the pile; cover the pile with successive layers of sewage sludge, clay, and black gravel; plant native desert plants on the pile. (2, 111)
- Response c
Except for the use of sewage sludge, this suggested variation is really not different from Alternative 2. There are several reasons for not considering sewage sludge as a suitable cover material or as a useful stabilizer for the tailings. The use of unprocessed (raw) sludge would increase the moisture and contaminant loads of the pile, produce gas pressure in the pile, increase the mobility of certain contaminants, and would probably be contrary to state standards for sewage treatment. Processed sludge has been treated to destroy the microorganisms; however, the material is organic (much like humus). Therefore, the material would decompose over time increasing the likelihood of settlement of the cover, ponding, and radon escape. In addition, there would not be enough processed sludge produced in the required time for remedial action.
- Comment d
Classify the tailings using a "dry airflow classifying process." (42)
- Response d
The benefits to be achieved by the indicated procedure were not stated by the commenter. No response is possible.
- Comment e
One individual specified a layered cover he thought proper: 9 feet of sand and crushed stone, but no liner. He also called for settlement gauges to control the rate of cover placement and to avoid embankment shear. (103)
- Response e
The cover suggested by this individual would probably meet EPA standards but would be more expensive than the cover proposed in Alternative 2 because of the greater volumes of material it would require.
- Comment f
The EPA noticed a reference to a well "abandoned and capped in the early 1960s (DEIS, page 72)," and commented that that well must be properly plugged. (204)
- Response f
All wells to be covered by the stabilized tailings will be properly plugged pursuant to state regulations and procedures before the tailings are finally put in place.

o Comment g

The Governor and his advisors said that partial burial is the state-of-the-art, not mounding as described in the DEIS for Alternative 2. They said further that liners should not be emplaced over areas where presumably contaminated water from sump pumps has been discharged. (209, 212)

o Response g

Besides being more expensive than above-grade disposal, partial burial of tailings at the Vitro site would result in more of the tailings coming into contact with the saturated zone and, consequently, an increase in the leaching of contaminants. Above-grade disposal is the best engineering practice in the Salt Lake Valley.

Regarding sump waters: It is proposed in the conceptual scheme that the installation of the liner system be closely coordinated with the required excavation and dewatering operations. In the operational sequence the contaminated materials are to be placed over the liner system prior to the abandonment of adjacent ground-water collection ditches and dewatering sumps. The projected weight of these materials will be more than sufficient to offset any potentially damaging uplift pressures resulting from the underlying ground-water conditions.

It should be noted that in light of the projected excavation depth and the placement of the granular bed, any uplift forces acting on the base of the clay liner will be relatively minor. For this study it was assumed that the average excavation depth would be on the order of seven feet below the adjacent grade. Thus, the base of the excavation would be approximately two to five feet below the projected ground-water table as described on page A-14. With the placement of a three-foot granular base, the maximum projected uplift pressure is equivalent to a two-foot head of water. In fact, this pressure will be more than offset by the dead weight of the recommended three-foot clay liner.

The return of sump waters to the ground would not increase the pre-remedial action contamination of the shallow aquifer under the site.

9. Comment.

A group made suggestions about disposal at the South Clive site under Alternative 3. They called for stabilization below grade (yet above the regional water table), riprap over the whole surface, not just the uphill toes of the mound, a half-mile buffer zone, Federal ownership or control of all land within 10 miles, and no use of the land for recreational vehicles or grazing. (110)

Response.

With the exception of exclusion of recreational vehicles, none of these suggested features of the disposal at South Clive are necessary to meet EPA standards. Stabilization completely below grade above the ground water would require an unnecessarily large tract of land, a situation the

DOE has tried to avoid within the design for Alternative 3. The entire surface will be covered with an erosion barrier. There would be no purpose served by requiring Federal ownership of all lands within 10 miles of the site; most of that land is already managed by the Bureau of Land Management, Department of the Interior.

6.10 COSTS, DIRECT AND INDIRECT

The State of Utah and the CVWRF Board were particularly critical of the DOE's cost estimates; a few individuals also had comments on the matter. The state's and the board's basic concern was that the DOE would use the very great difference in the projected costs between stabilization in place and moving to South Clive (almost \$40 million in the DEIS) to justify a choice of alternatives that is not desirable from the standpoint of health and safety. Altogether there were 15 written statements and 13 oral ones on this topic. These are summarized below, followed by the DOE's responses to the particular issues.

1. Comment.

Some commenters claimed that the cost differential of about \$40 million between stabilization in place and moving to South Clive is wrong.

- o Important costs of leaving the tailings at the Vitro site have been left out. These include site dewatering costs, replacement of the Vitro ditch, relocation of utility systems, relocation of roads, land acquisition, leachate monitoring and control systems, and formal value engineering of the final design. In addition, unit costs, particularly for imported clay, have been underestimated. (1, 6, 15, 16, 23, 35, 108, 206, 209, 211, 212, 213)
- o The design does not take advantage of possible cost savings in the plan for moving the tailings to the South Clive site. These include the use of two unit trains instead of three, combined with an improved unloading capability, the use of a more common type of train car, the lease instead of purchase of the train cars, the omission of the clay liner at South Clive, and the use of a better system than conveyors for transporting tailings material. (1, 15, 206, 209, 211, 212)
- o On the other hand, several persons said that the cost estimates for moving the tailings to South Clive are low because they do not allow for dewatering the site, hauling some materials on roads, inflation, and other unforeseen costs and charges. (4, 6, 108)

Response.

The costs for each subissue have been reviewed and are addressed in the alternatives and are included in Appendix A.

2. Comment.

Commenters claimed that the economic analysis of stabilization in place is inadequate in that long-term costs are not evaluated. There are more costs than just the engineering or capital costs of cleanup. Life-cycle costing favors tailings removal.

- o Comment a

The Central Valley Water Reclamation Facility will be economically affected in several ways. (15, 16, 21, 23, 107, 204, 206, 207, 211)

 1. Central Valley may have to buy land to make up for land dedicated to tailings disposal.
 2. The CVWRF Board will face increased costs of operation if the Vitro lands are only partially cleared of tailings. They will have to develop sludge disposal sites elsewhere or install expensive dewatering facilities.
 3. The CVWRF Board will face the loss of resource recovery benefits. The present long-term plans for the use of the land include a Resource Recovery Facility, which is to say a garbage-burning incinerator to recover useful heat energy. The land presently planned to be used for this facility would remain open under the stabilization in place alternative, but would have to be devoted to uses with a higher value, namely sludge disposal.
 4. The CVWRF Board will lose potential lease revenue. Their plan for the land includes a 20 to 25 acre industrial park for the southern end of the site. This land would be held for the eventual expansion of facilities and leased out in the meantime. If the site is only partially cleared, the Board would lose these revenues, which their economist estimates may be in the vicinity of \$4.5 million.

- o Response a
 1. The CVWRF Board's approved Master Plan identifies intended land uses on the Vitro site as follows:

- Mechanical treatment plant: 100 acres
- Sludge lagoons: 23-32 acres
- Temporary industrial park: 20-25 acres
- County resource recovery facility: 16 acres
- City culinary waterwell site: 1 acre

Based on the above land uses, for stabilization in place, it is agreed that Central Valley may have to purchase land to make up for the acres dedicated to the disposal of the tailings.

2. Yes, to the extent that stabilization in place results in insufficient acreage being available to Central Valley for sludge disposal, the development of alternative disposal sites or the installation of sludge dewatering facilities may be required.

3. The operational start-up of the municipal solid waste-to-energy facility is currently estimated to be eight to ten years away (Dahl, 1983). Therefore, it has been excluded from the analysis of the economic impact of remedial action options for the Vitro tailings site. With regard to the economic benefits lost to Central Valley, revenue from the lease or sale of the site to be occupied by the facility appears to be the only direct economic benefit lost to Central Valley if the facility is not built on the Vitro site. In addition, the question of whether the facility is municipally or privately owned and operated must be resolved.
4. Based on a 1983 market value of \$78,400 per acre, an annual lease rate equal to ten percent of the current market value and a 22.5 acre development, it is estimated that lost lease revenues would be approximately \$176,000 per year. Assuming that the temporary industrial park had a useful life of approximately 13 years, this corresponds to approximately \$2.3 million in lost lease revenues in 1983 dollars.

o Comment b

The economic development of all property adjacent to the site would be inhibited or even prohibited because of health and safety risks. Potential benefits which would be lost include more than \$697M within 30 years from capital investments, public revenues, and private sector income; more than \$82.1M within 30 years from taxes, licenses, and user fees; and more than 900 jobs within 20 years. If the tailings are not removed, depressed property values will continue. (1, 16, 17, 21, 25, 46, 107, 109, 110, 206, 209, 210, 212)

o Response b

Stabilization in place will not preclude development of the properties adjacent to the Vitro site due to health and safety risks.

In response to the following comments, the DOE commissioned an analysis of the economic impacts of alternative remedial actions. (See Economic Impact of Remedial Action Options, Vitro Tailings Site, City of South Salt Lake, Utah, FEIS, Appendix I.)

- "The sum of capital investment, public revenues, and private sector income resulting from the economic development of the Vitro site will exceed \$697 million within thirty years if not constrained by on-site stabilization."
- "Total taxes, licenses, and user fees resulting from Vitro site development will exceed \$82.1 million within thirty years."
- "Total wages, land rents, and business profits resulting from Vitro site development will exceed \$178 million within thirty years."
- "Employment generated by site development will increase from 465 jobs initially to over 900 jobs within twenty years."

Stabilization in place would likely result in land use restrictions that would preclude the development of a temporary industrial park on the CVWRF Board's 3300 South Street frontage property. The estimate of annual economic benefits associated with the operation of an industrial park on the 3300 South Street frontage property is set forth below (thousands of 1983 dollars).

- Public revenues	\$1,865
- After-tax wages	8,678
- After-tax corporate profits	315
- Rental income	<u>176</u>
Total	<u>\$11,034</u>

These data exclude the estimated construction cost of the temporary industrial park (\$11.0 million), as well as the estimate of additional economic activity due to the effect of the multiplier (\$15.4 million). The direct and indirect employment impacts of the operation of the industrial park are estimated to be 271 jobs and 434 jobs, respectively. Finally, it should be noted that the estimated life expectancy of the temporary industrial park is 13 years based on the CVWRF Board's adopted Master Plan.

- o Comment c
The additional 740 to 850 cancer-induced deaths over the 1000-year planning cycle have economic costs which must be specifically addressed in the final EIS. (16, 209, 212)
- o Response c
The DOE feels that costs associated with medical treatment, income loss, and other "what might have been" costs from cancer-induced deaths over 1000 years cannot be estimated with any degree of confidence.
- o Comment d
After the remedial action is done, there will be some monitoring and maintenance of the site required by the Nuclear Regulatory Commission. It is likely that the requirements for monitoring tailings stabilized in place would be more stringent than those for monitoring tailings moved to the South Clive site, because of the very great differences in populations surrounding the two sites. This would increase the cost of disposal at the Vitro site relative to the cost of disposal at the South Clive site.
- o Response d
Agreed. However, the surveillance and maintenance requirements will not be established until a license has been issued by the NRC. Therefore, costs cannot be estimated with accuracy. Regardless, it is doubtful that these costs would ever approach the cost differential between Alternatives 2 and 3.

3. Comment.

Commenters stated that if the tailings were removed from the Vitro site, the economic development of the surrounding area would result in the differential cost of stabilization and decontamination being recovered in ten years; the total decontamination costs would be recovered within 18 years. (1, 15, 17, 206, 209, 210, 211, 212)

Response.

The DOE has conducted this evaluation and its results are included as Appendix I and summarized in Section I.10. Table I-12 summarizes the estimated annual economic benefits assuming that the Vitro site were developed according to the CVWRF Board's plans (i.e., temporary industrial park). Total public revenues are estimated to be \$1,865,000 per year, total after-tax private sector benefits are estimated to be \$8,993,000, and annual rental payments to CVWRF are estimated to be \$176,000. This scenario also assumes that no other developable lands are available; a condition that is unlikely to occur in the foreseeable future.

4. Comment.

A private engineer wrote that the cost of Alternative 3, removal to South Clive, would be more than three times the cost of reprocessing and decontaminating the tailings on the site. (108)

Response.

The cost of Alternative 3, as described in this FEIS, would be about \$60 million. The net cost of reprocessing (see Appendix C, Section C.4) would be almost \$26 million, which can be added to the cost of Alternative 2, about \$31 million, to give an estimate of the costs of reprocessing and decontaminating the tailings on site of \$57 million. Alternative 3 would thus only be about 5 percent more expensive than the alternative of on-site disposal combined with reprocessing.

5. Comment.

The economic analysis of tailings removal to South Clive is incomplete.

o Comment a

Tooele County officials wrote that their county will experience long-term negative economic impacts if the tailings are relocated. (205)

o Response a

The DEIS (page 125) states "The loss of lease revenue to the state is estimated to be between \$25 and \$150 per year per section leased." Further, given the current and future uses of the area, it is the DOE's opinion that industrial or commercial development is highly unlikely. Thus, the only economic impact is that from loss of lease revenue.

o Comment b

One commenter wrote that relocation of the tailings would provide a small but real economic benefit because more jobs would be created than would be if the tailings were stabilized in place. (110)

- o Response b
Agreed.
 - o Comment c
There are nonmonetary costs associated with relocation which are not associated with stabilization in place. For example, because relocation requires a larger work force and increased handling of the materials, there would be a greater likelihood of work-related serious injuries. (104)
 - o Response c
Agreed. See Section 5.14.
6. Comment.
Two speakers discussed funding and costs of other alternatives.
- o Comment a
A private engineer asked if other alternatives - other than those discussed in the DEIS - could be funded. (35)
 - o Response a
This FEIS has identified and analyzed two reasonable alternatives. Several other alternatives were considered during the development of this EIS but were determined not to be reasonable (Appendix C) for further evaluation. Should additional alternatives become reasonable in the future, the DOE would consider the need for a supplement to this FEIS.
 - o Comment b
A private citizen asked for the costs of other alternatives, especially reprocessing. (39)
 - o Response b
Costs of certain other alternatives, including a state-of-the-art reprocessing alternative, are considered in Appendix C of the DEIS and this FEIS.
7. Comment.
A private citizen said that DOE should set "a maximum fee" for dealing with the tailings. If the people of Salt Lake or Utah prefer a more expensive option, they should pay the extra costs. (22)

Response.

Since publication of the FEIS, the State of Utah and the DOE have modified the cooperative agreement to identify the state as the party to perform remedial actions on the uranium mill tailings at the Vitro site and to reflect other agreements that result from this designation. In the case of allowable costs associated with State-performed remedial actions (excluding land acquisition) at the Vitro millsite, the Clive depository site, and the Central Valley vicinity property, DOE will pay ninety percent (90%) and the state will pay ten percent (10%) of allowable costs up to an amount equal to the mutually agreed estimated costs of

stabilizing the Vitro residual radioactive materials in place (\$42 million). DOE will pay seventy-five percent (75%) and the state will pay twenty-five percent (25%) of allowable costs which exceed the amount of the SIP cost estimate for relocation to the South Clive site.

8. Comment.

In reference to DEIS Section 5.9 (pages 130-131), a commenter wrote "DOE should discuss how it determined the number of individuals who would 'immigrate' to Salt Lake City to take remedial action jobs." He thought it likely that the small number of new jobs would be taken by local residents. "DOE should explain how its construction contractors will hire workers and under what conditions, if any, preference will be given to local workers." (110)

Response.

The estimates of the number of workers who would be attracted to Salt Lake City by a project of this size are based on past experience with similar situations as well as the assumptions described in the referenced section. Admittedly, the national labor market and current economic conditions can change the validity of past experience as an estimator of labor immigration. The estimated number of immigrants is seen to be small, compared to overall labor needs. DOE contractor's policies for hiring workers will be explained in engineering-design documents that will follow the EIS.

6.11 RADIOLOGICAL EXPOSURES AND EFFECTS

There were 9 written and 16 oral statements that discussed some aspect of radiation effects. The issues involved are summarized below, followed by the DOE's responses.

1. Comment.

Most commenters expressed general concern about the radiation exposures to the nearby populace. (e.g., 21, 110, 206, 209)

Response.

This concern was the basis for the Uranium Mill Tailings Radiation Control Act of 1978 (PL95-604).

2. Comment.

On the other hand, some commenters thought the concern overdone.

- o Two persons thought the levels very small. One spoke of them as "de minimis." The other said that "limited, intermittent contact with the pile would not constitute a major health hazard." (40, 102, 104)
- o Several persons from Tooele doubted that it could be demonstrated that anyone had died from cancer because of the presence of the tailings. (4, 8, 13, 40, 201)

Response.

The exposures to radon from the Vitro pile (Table 5.1) are indeed small compared to background (Table 5.3), but the radon release rates are well above the EPA standards and therefore the law mandates that there be remedial action.

3. Comment.

Several commenters found the presentation of expected impacts incomplete.

o Comment a

The EPA disagreed with the statement in the DEIS that "all doses and health effects would occur within 10 kilometers of the Vitro pile."
(204)

o Response a

This statement was indeed incorrect. It has been corrected in Section 5.1.4 of this FEIS.

o Comment b

Potential genetic effects should have been considered. (110)

o Response b

The intelligent commenter can make his own or her own estimates of genetic defects using the whole-body population doses given in Tables 5.1 and 5.2 of the DEIS and whatever risk factor he finds acceptable. The EPA appears to accept the following risk factors (EPA, 1982; Section 4.4.2):

0.04 to 0.6 serious genetic abnormalities per 1000 live births for the first generation.

0.14 to 5 serious genetic abnormalities per 1000 live births for all succeeding generations.

In each case, a lifetime exposure of the gonads to 100 mR/y (approximately background) is assumed. The International Commission on Radiation Protection (ICRP, 1977) estimated the genetic effects to be less than somatic effects for a given population dose, therefore, only risk of somatic effects must be considered.

o Comment c

The DEIS failed "to give much credence to nonmalignant diseases caused by exposure to ionizing radiation." (110)

o Response c

The DOE is unaware of risks of nonmalignant diseases caused by exposure to the relatively low levels of ionizing radiation that occur on the Vitro pile. Cataracts may be what is spoken of; but the minimum x-ray dose capable of causing a clinically significant cataract is thought to lie between 600 and 1000 rad in adults (Eisenbud, 1973:33).

o Comment d

The DEIS should have addressed the cumulative effects on workers of exposures to radon and external gamma radiation. (110)

- o Response d
It is believed that "the cumulative effects on workers of exposure to radon and external gamma radiation" during construction were addressed in Section 5.1 and Appendix F of the DEIS. It is agreed that exposure of workers on the pile will have to be limited to 5 rem/yr. This point is discussed further in the section on mitigation, 5.19, of this FEIS.

4. Comment.

There should be some discussion in the document of the consequences of the Vitro tailings having been present and unprotected for over a decade.

- o Several persons from the Salt Lake Valley said that there are already elevated levels of cancer among nearby residents and workers and are worried about their own health. (20, 27, 34, 36, 49)
- o Two persons pointed to studies said to demonstrate the link between the tailings and cancers. (34, 49) Several blamed their own or their relatives' cancers on the tailings. (3, 27, 33, 43, 52) Two persons offered lists of cancer victims. (27, 47)
- o Two people told of grotesquely deformed fish having been caught in Mill Creek and the Vitro ditch. (27, 47)

Response.

In 1981, the natural incidence was such that about one in six persons died of cancer. Section 5.1.4 of the main text of this FEIS indicates that the calculations predict an additional cancer death in Salt Lake Valley due to the tailings every 5 to 6 years. There is no way to tell which of the many cancers that do occur may be attributable to the tailings.

In any case the decision has been made for remedial action. What the effects of the pile having been there in the past are, does not affect that decision except to emphasize that no action is not a satisfactory alternative.

5. Comment.

There were several comments about the present radioactive state of the Vitro tailings and their environs.

- o Comment a
The underlying soil is contaminated. (34) More data are needed on this contamination, as the evidence suggests that it is much deeper than stated in the DEIS. (110)
- o Response a
Agreed. The depths of contamination stated in the DEIS were based on the evidence available at the time the DEIS was written. During remedial action the contamination will be removed until the Ra-226 standard is met. However, for purposes of this EIS, the DOE believes the information to be sufficient to ascertain, and bound, the impacts from the remedial actions.

- o Comment b
The ground water is contaminated, and there is the suggestion in the data that the deeper, partially confined ground-water system is already contaminated. (110, 209, 214)
- o Response b
This subissue is addressed in Appendix D, and in Section 5.4 of this FEIS.
- o Comment c
The DEIS says there is no contamination in the Jordan River sediments, but Dr. Pendleton "traced contamination for some distance down the river in years past." (204)
- o Response c
The DOE has inquired into the existence and availability of Dr. Pendleton's data regarding radiological contamination of water or sediments of the Jordan River. These data, available at the University of Utah, will be reviewed by the State of Utah prior to completion of the final design. Dr. Pendleton's radiological investigations regarding soil concentrations were reviewed in ORNL/TM-5251 and incorporated into Appendix F of the FEIS.
- o Comment d
"No measurements of ambient-air radon concentrations on the Vitro site itself were available for use in the impact statement." The commenter went on to say that the DEIS reports radon concentrations at 6 feet above the surface of the tailings, but does not point out whether the radon daughters are in equilibrium. (5)
- o Response d
Data from long-term radon concentration measurements on and around the site (40 locations) are presented and used in the revision of Section 4.8 and Appendix F. A dose conversion factor developed in Appendix F

$$7.3 \times 10^{-5} \frac{\text{rem}}{(\text{hr-pCi/l})}$$

was used to convert radon concentration to dose to the lungs from radon inhalation. Implicit in this dose-conversion factor is an assumption of 25 percent equilibrium between radon-daughter products and radon.

- o Comment e
There were two comments about techniques of measurement. One man said the DOE should use an apparatus recently perfected at the Idaho Falls laboratory to determine the isotope of uranium-226 (sic, he probably meant radium). (32) Another said the DOE should develop a statistically sound sampling scheme "to gain a representative Ra-226 average over the entire 128 acres of the Vitro site." (110)

- o Response e
The techniques used by the DOE to measure Ra-226 concentrations are believed to be sound and generally acceptable. New data based on the statistically designed sampling by MSRD (1982) are presented for U-238, Ra-226, and Th-230 in the revision to Section 4.8 and Appendix F.

6. Comment.

The accident analyses in the DEIS (Section 5.1.5 and Appendix F.2.3) are an adequate assessment of the radiation exposure pathways and a reasonable estimate of doses due to a hypothetical accidental spill of material on land. (215)

Response.
Agreed.

6.12 HEALTH EFFECTS AND CONVERSION FACTORS

Several statements (3 written and 2 oral) had observations to make about the way health effects are inferred from radiological exposures.

1. Comment.

Several persons and organizations questioned the conversion factors used. The EPA questioned the statement in the DEIS that the factors used for lung cancer incidence from radon daughter exposures overestimate the risk. The estimates used fall in the low- to mid-range of those used by many groups. Moreover, according to BEIR-III for high LET radiations the linear hypothesis is less likely to lead to overestimates of risk, and may in fact lead to underestimates. (204)

Response.

The risk factors used in the DEIS are, in the DOE's opinion, realistic estimators of the true risk of lifetime cancer death. The text has changed "overestimate" to "estimate realistically". It should be pointed out, however, that literature values range from 13 to 102 lung cancer deaths per million man-rem of dose commitment due to inhalation of radon-daughter products, and from 50 to 621 cancer deaths per million man-rem of dose commitment due to gamma exposure (Cohen, 1981; Evans et al, 1981; Harley and Pasternack, 1982; National Academy of Science, 1980; National Academy of Science, 1972; United Nations, 1972; United Nations, 1977; United States Radiation Policy Council, 1980). Thus, the factors used in predicting cancer deaths in this FEIS are probably accurate to within a factor of 5. Since the same risk factors were used throughout this report, intercomparisons of radiological impacts between the two action alternatives are valid, regardless of the accuracy.

2. Comment.

The EPA also said that since "the BEIR III gamma risk factors are based on misinterpretations of Japanese exposure data (which are now being reassessed), we recommend that until new risk factors are developed, BEIR I or other sources for gamma risk coefficients be used." (204)

Response.

In another context (DOE 1982c) the EPA recommended using 200×10^{-6} per man-rem instead of 120×10^{-6} per man-rem. The DOE thinks such a substitution premature and, in any case, a substitution that would not change the comparison between action alternatives.

3. Comment.

A group representative said the DOE should discuss in greater detail why it selected the radon and EGR risk factors it did. He also asserted that estimates were made only for healthy, adult members of the population. (110)

Response.

The conversion factors used are for a demographically based distribution of ages and sexes, and therefore implicitly included young and old people and people of less than perfect health. See also the responses above to the EPA and to Issue 4 below.

4. Comment.

One man said that the hazard attributed to radon is grossly exaggerated, saying that the usual conversion factors are wrong. (2, 111)

- o He believed the inferences from the uranium miner data are false because they are inconsistent with data from uranium mill workers. The former breathed contaminated dust, the latter radon gas. Moreover, these epidemiological inferences are confounded by the prevalence of smoking among the miners.
- o He said that the standard assumption of a linear, non-threshold response to radiation is not provable, and implied that health effects are therefore inevitably overestimated.

Response.

An excess lung cancer risk has been observed among several groups of underground miners exposed to Rn-222 and its daughters: uranium miners in Colorado, Czechoslovakia, and Ontario, fluorspar miners in Newfoundland, and several smaller groups of nonuranium miners working in hard rock mines in Sweden and England. The results of these epidemiological studies are discussed in detail in a report of the United Nations Scientific Committee on the Effects of Atomic Radiation, published in 1977.^a These studies led the International Commission on Radiological Protection to estimate^b a total lifetime risk for lung cancer of

$$1.5-4.5 \times 10^{-4} \text{ per WLM.}$$

^a "Levels and Effects of Ionizing Radiation." UNSCEAR, 1981.

^b "Limits for Inhalation of Radon Daughters by Workers." ICRP Publication 32, 1980.

The data have also been reviewed by the National Academy of Sciences' Committee on the Biological Effects of Ionizing Radiation (BEIR)^a together with data from experimental studies with animals designed to elucidate the processes involved. The synergistic link with smoking is well known and continues as a matter of intense research interest; the experimental evidence, for instance, shows that the origin of tumors in animals is deep in the lungs, whereas human cancers induced by cigarette smoking or exposure to environmental agents nearly always arise high in the lungs.

The lifetime risk factor used in this FEIS is one suggested by an international group of experts^b as modified by a changed definition of the WLM due to Harley and Pasternak^c, equivalent to

$$2 \times 10^{-4} \text{ per WLM.}$$

The BEIR report^c also discusses at length the linear, non-threshold hypothesis for radiation exposure. It chooses to follow a linear-quadratic but still non-threshold response. This very likely does tend to over-estimate health effects somewhat.

The DOE and its contractors feel that they must follow the lead of these experts in documents such as this.

5. Comment.

One man said that the danger from radon is exaggerated, "I am afraid there has been some intentional fear-making ... we do not have a runaway nuclear pile sitting across the street." (22)

Response.

The DOE does not believe that fears have been deliberately incited; the fears expressed are real and a product of the times.

6.13 LAND USE

Several statements (12 written and 9 oral), especially those of the Central Valley Water Reclamation Facility Board, commented on the proper and best use, as well as the value, of the land at the Vitro and South Clive sites. These comments are summarized below together with the DOE's responses to them.

1. Comment.

The CVWRF Board purchased this large tract of land for the specific purpose of constructing a waste-water treatment plant and having adequate land available for long-term expansion. This site was specifically

a "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980." NAS, 1980. See Especially Page 308 and Following.

b "Estimate of Risk From Environmental Exposure to Radon-222 and Its Decay Products." Nature 290, 98-100.

c "Environmental Radon Daughter Alpha Factors in a Five-lobed Human Lung." Health Physics 42, 789-800. See Especially Page 793.

selected to accommodate a long-term need at the least long-term cost. Moreover, it was purchased with the promise from the Federal government that it would be immediately cleaned up and that all of this land would be available for their purposes. All of this land is needed. (15, 18, 107, 110, 204, 207, 209, 212)

Response.

It is agreed that the CVWRF Board purchased the "large tract of land" for the construction of a waste-water treatment plant and to facilitate long-term expansion (Final Report, 201, Facilities Plan, CVWRF Board). In addition, it is agreed that the land was purchased contingent on a promise by the Federal government to clean up the property and make it available for "Central Valley purposes." This is supported by their approved Master Plan, which identifies intended land uses in the Vitro site as follows:

- o Mechanical treatment plant: 100 acres
- o Sludge lagoons: 23-32 acres
- o Temporary industrial park: 20-25 acres
- o County resource recovery facility: 16 acres
- o City culinary waterwell site: 1 acre

However, the DOE disagrees that "...it would be immediately cleaned up...." Remedial action is contingent upon many time-consuming processes required by law. Regardless, alternative 3 is DOE's preferred alternative and the land will be available to the CVWRF Board upon completion of the remedial action.

2. Comment.

The tailings are presently and will continue to be an eyesore and an aesthetic blight. If the tailings are stabilized on the site, it will mean a pile 45 feet high -- four and a half stories. This would be a very unaesthetic monument to a giant Federal mistake. (17, 20, 109, 209)

Response.

It is agreed that the unstabilized tailings are something of an eyesore. But the DOE disagrees that the tailings stabilized according to the plan of Alternative 2 would constitute an "aesthetic blight" on what is already a functional-appearing industrial warehousing neighborhood, not unpleasant to look at, but hardly a residential or commercial district that requires extremely pleasing surroundings in which to conduct daily business.

3. Comment.

Stabilization in place will prohibit development of the prime industrial land adjacent to the site, will constrain development of other nearby lands, and may discourage further development elsewhere in the Salt Lake Valley. At the present time there are vacant fields within one-half mile of the site; this vacant land is valued at from \$100,000 to more than \$193,000 per acre. (17, 21, 109, 206, 209, 210, 211). One person quoted a local planner as saying that "the Vitro site is the prime industrial property in the western United States." (211).

Response.

Stabilization in place will likely result in land use restrictions that will preclude development of the Vitro site's 3300 South Street frontage property as a temporary industrial park. However, the development of an alternate parcel as an industrial park is a possibility. In addition, it is not anticipated that stabilization in place would prohibit the development of adjacent properties or discourage development elsewhere in the Salt Lake Valley.

The estimate of \$193,000 per acre for the market value of vacant fields within one-half mile of the Vitro site is noted. However, the DOE analysis of local land values does not support this estimate of the market value of vicinity properties. A 22.71-acre site at 3300 South Street and 900 West Street is currently (1983) being offered for sale by the Utah State Retirement Fund for \$1,978,495 or approximately \$87,120 per acre. A spokesperson for the Utah State Retirement Fund stated that a recent appraisal of the property did not mention the property's proximity to the Vitro site or the uranium mill tailings (Blackburn, 1983).

Based on the preceding, the difference between the aforementioned estimate of \$193,000 per acre and the asking price for the Utah State Retirement Fund's adjacent property can not be attributed to the property's proximity to the Vitro site.

The following data were provided by the Chairman of the Board (Petersen, 1983) and the General Manager (Dahl, 1983) of the Central Valley Water Reclamation Facility. These data summarize transactions involving the Vitro site, as well as the site of the waste-water treatment facility.

Year	Parcel Size (acres)	Purchase Price (dollars/acre)	Description
1953	39.0	\$ 3,500	District One's ^a purchase of the site for the treatment plant
1980	39.0	50,000	Sale of the site to Central Valley
1975	25.5 & 16.0	9,000	Tracts "B" and "C" north; purchased by District One
1980	25.5 & 16.0	10,000	Tracts "B" and "C" north; sold to Central Valley by District One
1981	12.5 & 14.3	62,500	Tracts "B" and "C" south; sold to Central Valley by Richards-Moench

^a A predecessor organization, and now a member, of Central Valley.

Finally, the current market value of Central Valley's 3300 South Street frontage property is estimated to be \$78,400 per acre. These details are included in Appendix I of this FEIS.

4. Comment.

One private citizen questioned whether or not the Central Valley Water Reclamation Facility really needed all of its land. He suggested that because of advances in sewage technology, the sewage treatment plant will not need as much land as their plans indicate. He also suggested storing dewatered sludge on the tailings pile and making the pile deeper to decrease the area of land covered by the pile. (2, 111)

Response.

There is no doubt that the CVWRF Board could profitably use all of the 128-acre site; its plans for use of the land were outlined in Section 4.9 of the DEIS. The CVWRF management is presumably well aware of advances in sewage technology and how those advances might influence planning. Regarding the use of dewatered sludge, see responses to Issue 8, third response, Section 6.9. It is preferable to prevent the tailings from contacting ground water; thus, the final embankment cannot be completed below grade (deeper) or partially below grade because of the high water table.

5. Comment.

One citizen, referring to the Vitro site, asked, "How much an acre was the site sold for ((presumably to the CVWRF)) and what is the value of the property today?" She also asked if the 128-acre figure given on page one of the DEIS were correct. (4)

Response.

In 1979, the CVWRF Board bought the last 29 acres of the present, 128-acre site for about \$62,000 per acre. The DOE's recent economic study shows that, if cleared of tailings, site land would be valued at \$78,400 per acre in 1983. The 128-acre figure is believed to be accurate within a few tenths of an acre.

6. Comment.

The possibility of restrictions on the placement of building foundations near the stabilized mound (alternative 2) was raised. The DOE should explain the reason for this and its potential effect on the CVWRF expansion plans. (204)

Response.

The reasons for restrictions were presented in the DEIS, Section 5.6, Impacts on Land Use (page 124).

7. Comment.

A few comments focused on land use and value in Tooele County.

o Comment a

Tooele County will be limited and prohibited from future use of these remote lands. Potential future use includes mining and chemical plants. (7, 12, 205)

- o Response a
It is agreed that any use of the South Clive site will be prohibited if Alternative 3 is implemented. The South Clive site, as well as most of the land within a 10-mile radius of the site, is characterized by poor soil conditions and sparse vegetation. Current land uses are limited to sheep grazing, jackrabbit hunting, and occasional recreational vehicle driving. The site is currently owned by the State of Utah, while most of the land within a 10-mile radius of the site is public domain administered by the Bureau of Land Management. Based on considerations of technology and raw materials requirements, the site has virtually no resource value. In addition, its remoteness from the urbanized areas of Tooele County makes it an improbable location for a chemical plant. Based on the preceding, it is incorrect to characterize potential future land uses as including mining and chemical plants. Therefore, it also is incorrect to value the site on the basis of it being a potential location for a chemical plant.
- o Comment b
If the County is reimbursed for this land, the "assessed valuation of this plot should be on a chemical plant basis, not on waste ground."
(7)
- o Response b
This subissue is beyond the scope of this EIS. It has not been established that Tooele County must be reimbursed for this state-owned land or, should it be so established, what the basis of assessment of land value should be.
- o Comment c
The Governor said that if the DOE chooses to exchange some Federally-owned land for the state-owned South Clive site, the exchange should be made before construction begins. Otherwise, DOE will need to get a special-use permit from the Division of State Lands and Forestry. A right-of-way permit may also be needed to provide access across other state lands. (209)
- o Response c
The question of the ownership of the South Clive site will be resolved prior to construction. In addition, if a right-of-way permit is required to gain access to the South Clive site, it will be obtained prior to construction.

6.14 NONRADIOLOGICAL IMPACTS

There were 3 written and 9 oral statements that discussed nonradiological impacts. These and the DOE responses to them are given below.

1. Comment.
Several persons spoke of the dust hazard. They apparently were not speaking so much of its radiological effects as of the problems associated

with dust concentrations so high that those downwind sometimes have to wear eye coverings and cover their noses. Dust, they said, is inevitable, although it can be alleviated by keeping the working areas wet. (5, 20, 22, 31, 34, 50, 52)

Response.

Production of dust during the construction phases of Alternative 3 will be kept as low as is practicable; this may require the wetting down of the excavated materials during dry periods. The commenters should note that dusting from the present, 128-acre site will be substantially reduced upon completion of the remedial action.

2. Comment.

Several persons brought up the issue of heavy metals. (209, 212, and others)

o Comment a

There was a complaint that "the technical document does not specifically deal with heavy metals or any of those constituents." The commentor specifically mentioned hexavalent chromium; he was talking about the presence of heavy metals in and their transport by ground water. (6)

o Response a

The DEIS did address the problem of heavy metals. This was done in Section A.4.2.2 of Appendix A, where the transport rates of thorium, lead, uranium, arsenic, selenium, chromium, and silver were compared with the transport rate of radium in clays or silty clays typical of the Vitro-site (Table A-4). Of these, only chromium is transported more rapidly than radium (5 times as fast) and neither of these elements moves with the full ground-water speed. The DOE estimates a 0.026 percent site-weighted average for the chromium content of the tailings; this amounts to 264 grams per ton, or 2.6 times the average crustal abundance of chromium. The compounds formed of chromium in the tailings are unknown; but it appears that they are relatively insoluble compounds. Chromium concentrations in waters drawn from shallow wells drilled in the tailings are all less than 0.05 mg/ , which is the maximum concentration allowed in drinking water. Further discussion of the heavy metal problem can be found in Appendix D of this FEIS.

o Comment b

"The heavy metals present in the tailings will never burn out." Hexavalent chromium was again mentioned. (18, 202)

o Response b

Agreed. See response in previous paragraph.

3. Comment.

A Tooele County official and EPA questioned the data in Section 5.14 of the DEIS which indicated there would be a higher incident of construction-related problems and disabling industrial accidents at the Salt Lake site than at the South Clive site. (6, 204)

Response.

The estimates of expected number of work-related accidents given in Table 5-12 of the FEIS have been recalculated to reflect changes in the alternative designs, manpower, and incidence rates of the Utah Department of Transportation and others. Table 5-12 indicates that disabling injuries (defined as a death or lost work days) among construction workers is more than twice as great for Alternative 3 than for Alternative 2.

6.15 PSYCHOLOGICAL IMPACTS

Many statements (3 written and 13 oral) included mention of the fear and worry that the tailings arouse among people.

1. Comment.

In Tooele County, the prospect of having these tailings in the same county as themselves causes people to expect their part of Utah to be stigmatized as a general dumping ground for the nation's wastes. (6, 7, 8, 11, 13, 201)

- o The military's nerve gas supply, including the Weteye missile, is already stored at the Tooele Army Depot.
- o It was near the Dugway Proving Ground in Tooele County that several years ago a number of sheep died from exposure to poison gas. This incident received wide coverage in the national press.
- o People from out of state, and even some Utah residents, are apprehensive about traveling along Interstate 80 west of Salt Lake City and only two miles north of the South Clive site.

Response.

The DOE appreciates Tooele County concern over being stigmatized as a general purpose dumping ground. The feeling is real, although in DOE's opinion based on an unjustified fear of low level radiation. The tailings are such a low-level source that unless one is right on top of or next to the tailings themselves, the amount of additional irradiation one receives is no more than the normal variation in background. When the tailings are moved to South Clive, they will be covered and isolated from ground water.

These tailings must be cared for. The present situation of having bare tailings sitting uncontrolled in the middle of a major metropolitan area cannot be permitted to continue.

2. Comment.

In Salt Lake County, the presence of the tailings means that people wonder about their future health because of having lived, worked, or regularly driven near the Vitro site. (17, 21, 30, 33, 44, 46, 47, 53, 105, 109)

Response.

The DOE also appreciates the worries of the residents of Salt Lake Valley, and its message to them is the same as its message to the residents of the Tooele County.

6.16 MAINTENANCE AND MONITORING

A number of statements (3 written and 2 oral) thought the discussion inadequate regarding maintenance of the final disposal site after remedial action and monitoring of effluents both during and after remedial action. The issues are summarized below, followed by the DOE's responses to them.

1. Comment.

There is not enough discussion of these matters in the DEIS. Surely some maintenance will be needed after the work is done, even with the best designed plans. And even more certainly, the work sites will have to be monitored during the remedial action, to assure the safety of the workers and of residents, and after the remedial action to check on the performance of the design and to be able to take further action if required. The DEIS makes no firm commitments in these matters. (6, 18, 202, 203, 215)

"Active surveillance and monitoring will have to continue indefinitely if it is left in the heart of the Salt Lake Valley." (202)

Response.

The DOE agrees that maintenance and monitoring will be necessary, regardless of the alternative. Details of the plans for these activities are available in the UMTRA Project Environmental Health and Safety Plan, the Project Licensing Plan, and the Remedial Action Plan. These documents will be subject to review and approval by the NRC and the state and will be available to the public at the reading rooms and libraries listed at the beginning of Section 6.21.

The program under consideration for doing the remedial action includes both environmental and occupational monitoring with systems designed to detect the low levels of radioactivity that may be transported by air or water.

The long-term surveillance and monitoring program will be designed to assure that the final site remains undisturbed and continues to function as designed. The surveillance will consist of periodic walkovers with an emphasis on examining erosion protection features, cover and fence integrity, and other engineered features such as diversion channels and vegetation. Ground water may also be sampled. Maintenance will be needed.

2. Comment.

The level of maintenance and monitoring required will surely be greater if stabilization on site is chosen rather than removal of the tailings to the South Clive site.

Response.

The DOE agrees, insofar as maintenance and monitoring after completion of the remedial action is concerned. However, the degree of monitoring required during the remedial action will be greater if the tailings are

moved than if they remain in place. The Vitro site will have to be monitored under either alternative; the South Clive site and the transportation route will have to be monitored only if the tailings are moved.

6.17 MITIGATION MEASURES

Several statements (5 written and 7 oral) commented on possible mitigation measures. These comments are summarized below together with the DOE's responses to them.

1. Comment.

Several commenters suggested ways to make moving the tailings to South Clive more palatable.

- o Tooele citizens suggested that if the tailings are moved, Utah licensed contractors should be given a 5 percent preferential treatment in all bidding procedures; Tooele County contractors should be given an additional 5 percent incentive. The Federal Government should pay Tooele County for the use of its land; payment might be in lieu of taxes. Payment should be at the rate assessed for chemical plant locations and should be distributed to the local governments which represent the citizens of Tooele County. (7, 205)
- o A Tooele resident said, "give us the property in there ((Vitro)) ... in exchange for this property out here ((South Clive))." (9)
- o Another Tooele resident said that profits would be made from relocating the tailings and that half of these profits should go to Tooele. (12)
- o Also, Tooele should be given a written guarantee to protect the county against any possible, unexpected effects and a guarantee that no other waste material would be placed in Tooele County. (12)

Response.

Although the DOE recognizes the concerns of the commenters, the DOE has no plans for preferential treatment of contractors, compensation of Tooele County for use of its land, distribution of Federal payments for land, or for provisions of guarantees.

2. Comment.

Several commentors suggested ways to make stabilization in place more palatable.

- o Comment a
The mayor of South Salt Lake said that stabilization in place is "out of the question unless the DOE is willing to compensate the City, School District, County, and State for the loss of potential revenue and community economic strength should the area have been allowed to develop." (17, 109)

- o Response a
This subissue is beyond the scope of this EIS. See the response to Issue 1.
 - o Comment b
A private citizen asked if anything could be done to compensate for the CVWRF's loss of land. (2)
 - o Response b
The CVWRF Board would of course be compensated for any land used in the implementation of Alternative 2. The amount and manner of compensation would be determined outside of the NEPA process.
 - o Comment c
He also suggested that warning monuments be placed about the site. Appropriate warnings would include the following: no irrigation within the area; radon barriers beneath all buildings; elevated air intakes for building ventilation; reburial of all excavated tailings; containment of all water lines. (2)
 - o Response c
Some types of warning monuments would probably be required by the NRC as a condition of granting a license to maintain and monitor a uranium mill tailings disposal site. The DOE believes that advocating "radon barriers beneath all buildings" and "elevated air intakes for building ventilation" will not be needed.
 - o Comment d
Another citizen implied that people in the Vitro area must absorb higher health care insurance rates. (36)
 - o Response d
This citizen seems to imply that people or businesses located relatively near the site have higher health-insurance bills than their counterparts who are located well away from the site. No evidence of a difference in insurance rates was supplied by the commenter, so no further response is possible. In any case, cleanup of the site and stabilization of the tailings will eliminate the conditions that insurance companies might cite as justification for charging higher rates to policyholders located near the tailings pile.
3. Comment.
In reference to page 33 of the DEIS, the EPA suggested a way to minimize the chances of erosion of a stabilized pile by appropriately choosing and maintaining a vegetative cover. The plant species must be chosen so that the integrity of the cover material is not breached by deep-rooted plants. The material over the clay cap should be thick enough to preclude a saturated zone over the clay, creating a zone that would encourage deep-rooted species. To maintain a healthy plant community, it should be periodically cropped or grazed. Temporary runoff and sediment-control measures may be needed for a few years until adequate plant cover is established. (204)

Response.

Subsection 3.2.3.5 of the DEIS mentions the possibility of establishing self-sustaining vegetation on the cover of the stabilized tailings in Alternative 2. The cover design for Alternative 2 has been revised in this FEIS.

Comment.

Several comments discussed minimizing the possibility of adverse health effects or accidental exposures.

- o Comment a
The mitigating measures during remedial actions (Section 5.19) are important for reducing the radiation exposure of construction workers and the public and should be fully implemented. (215)
- o Response a
Agreed.
- o Comment b
When the tailings are being transported by rail, the cars should be sealed; they should be washed down afterwards. Average train speeds of less than 10 miles per hour would reduce the chance of an accident that might release the tailings. Tailings should be moved during hours of least vehicle movement on Interstate 80. (110)
- o Response b
The maximum train speeds for the unit trains proposed in Alternative 3 will be determined by the Denver and Rio Grande Western Railroad or the Union Pacific System. The DOE believes that restrictions on the hours of train operation would serve no purpose and would needlessly prolong the time required to complete Alternative 3.
- o Comment c
"Worker exposures during remedial action can be lessened by the wearing of respirators, frequent relocation to work areas not containing radioactive materials, and other shielding measures. DOE should list what mitigation measures it plans to require for contractors employing remedial workers." (110)
- o Response c
The means for reducing worker exposure that are mentioned by the commenter are reasonable and, if necessary, will be employed during remedial action. The methods to be used to minimize worker exposure during the South Salt Lake portion of the remedial action will be described in the Remedial Action Plan, a document that will be reviewed and concurred in by the state and the NRC.
- o Comment d
A Tooele official suggested that high levels of radon and radon-daughter products in structures over the existing site could be reduced by incorporating greater rates of air exchange within the structures. (6)

o Response d

There are no structures on the existing 128-acre Vitro site. Increased ventilation as a means of reducing radon and radon-daughter products, has been and may again be used as an option for remedial action on those vicinity properties for which removal of underlying contaminated material would be impractical or excessively expensive.

6.18 ARCHAEOLOGY

Comment.

One man spoke in the hearings saying that the South Clive site is a likely location for archeological artifacts. (22)

Response.

As indicated in Section 4.11.3 of the DEIS and this FEIS, the South Clive site has been surveyed by professional archaeologists. No cultural resource sites were identified but one isolated artifact was found: four pieces of broken purple glass from some unknown historic glass object. Such a find does not indicate the existence on the site of significant archeologic artifacts.

6.19 EDITORIAL COMMENTS

Six written statements included comments which are editorial in nature. These are listed below.

1. Comment.

More effort should be given to explaining concepts and technical jargon. The Glossary and List of Acronyms are helpful, but could be more extensively referenced in the text. (110)

Response.

The DOE has attempted to reduce the use of technical jargon in the introductory chapters of this FEIS (Chapters 1-3). The reader is also urged to consult the Glossary and List of Acronyms for definition of unfamiliar terms.

2. Comment.

On page 110, Table 5-3 is very confusing, mixing backgrounds and the limits from the EPA standards translated to dose. Furthermore, it appears that the proposed, not the final, standards were used for inference. (204)

Response.

Table 5-3, "Background Radiological Levels and EPA Limits," has been revised in this FEIS. Proposed standards were indeed used for inferences in the DEIS since the final standards had not been published by the time the DEIS was ready for printing. The final EPA standards are addressed in Section 3.1.1 of this FEIS.

3. Comment.

On page F-14, in common physics and chemistry parlance, "standard temperature" is 0°C, not 70°F. (204)

Response.

Agreed.

4. Comment.

On pages F-19 to the end, presumably the rest of the monitoring data from the TLD's, etc. will be presented in the final EIS. (204)

Response.

A summary of these data is included in the FEIS.

5. Comment.

On page 74, "may" should be changed to "will" in the statement "The high salinity of the ground water in the South Clive area may limit its use . . ." (209, 214)

Response.

Agreed.

6. Comment.

On page 59, the value for horizontal acceleration at Vitro is 21 percent g; on page 116, the value is 23 percent g. Which is correct? (209, 214)

Response.

The 23 percent g value is correct.

7. Comment.

There are mathematical discrepancies between Tables 1.1, 1.2, and 1.3 for Alternatives 2 and 3. (209)

Response.

These tables have been revised for this FEIS.

8. Comment.

Several commenters pointed out typographical errors.

- o On page 22, paragraph 5, line 1, "affect" should be "affects." (204)
- o On Page 48, "Dave Finerfrock" should be "Dane Finerfrock." (204)
- o On page 59, the figure for horizontal acceleration is 21 percent g or 0.21 g, but cannot be 0.21 percent g, as indicated in the text. (209)
- o On page 79, Section 4.8, the second sentence of the introductory paragraph should read: "Radiological dose rates and exposure are presented in millirem/year and microroentgens/hour, respectively." (110)

- o On page 116 reference is made to "Choar, 1969;" the references on page 143 list "Chow, 1969." (110)
- o On page F-11, Pb-201 should be Pb-210; on page F-41, 100 m should be 100 μ m. (204)

Response.

All of these typographical errors have been corrected in the material that is common to the DEIS and this FEIS.

6.20 OUT-OF-SCOPE COMMENTS

The CEQ regulations governing the preparation of environmental documents such as this FEIS state that "the NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment." In the present instance there is the problem of what should be done about the Vitro tailings. The decision to be made is to choose among the reasonable alternatives for remedial action. This FEIS is intended to provide the environmental input to that decision, but it will not be the only input; there will also be policy and financial inputs.

However, a number of the comments made orally and in writing on the DEIS are not really relevant to the environmental inputs to that decision. In spite of their not really being relevant to the purpose of this FEIS, the DOE does recognize their existence in the subsections that follow, even though a number have been mentioned earlier. The DOE has attempted a response to some of these out-of-scope comments.

6.20.1 Personal Preferences

Some letters and statements did not discuss any specific issues in the DEIS but expressed the authors' preference for one or another of the alternatives examined in that document. Even those letters and statements that did comment on specific issues usually also stated preferences. These preferences distribute themselves as follows:

	Alternative 2 <u>In Place</u>	Alternative 3 <u>South Clive</u>	Some other <u>alternative</u>	No pref- erence <u>stated</u>	Totals
<u>Persons and Groups</u>					
Tooele County persons and officials	15	0	2	2	19
Salt Lake Valley persons and officials	2	34	3	1	40
State Officials	0	4	0	2	6
Other area persons	1	1	0	0	2
National agencies	0	1	0	2	3
<u>Totals</u>	18	40	5	7	70

(No one preferred no action.) This summarization lumps letters and oral statements together and removes potential double entries such as the same person speaking twice or giving an oral statement, and also submitting written comments.

Generally speaking, the attitude of the Tooele people was: don't bring it here, but we don't want to wish it on the Salt Lake Valley people either. The "other" entries refer to people who were trying to suggest alternatives that wouldn't require the tailings to remain in the valley. The general attitude of the Salt Lake people was complementary: they didn't want it left in the valley, but they didn't like wishing the problem on Tooele County. They did not as much say, "take it to Tooele" as, "take it away from here."

A few of the letters expressed disapproval of one or another national policy or direction. Things mentioned, inter alia, included the nuclear freeze, the monster of a nuclear age, the MX racetrack, Love Canal, and Times Beach.

6.20.2 Bias

The issue of bias in the Vitro DEIS was raised in 3 letters and 7 oral statements. These comments can be summarized as follows:

- o Although it does not explicitly state a preference, the DEIS reflects a bias towards moving the tailings to South Clive and does not present the facts in an objective manner. (2, 4, 6)

- o The document lacks candor concerning the issues and problems associated with the Vitro site and stabilization in place. Its cost figures are loaded by omission of important costs on the one hand and by exaggeration of costs on the other. It appears that the DEIS is attempting to justify stabilization in place. (15, 18, 23, 110, 209, 210)
- o The DEIS does not recognize the strength of the personal feelings of the many people affected by the alternatives proposed. (39)
- o The DEIS was prepared by people in Denver, Albuquerque, and Washington and therefore does not keep the best interests of the local people in mind. (14, 17, 41)

Response.

The DOE and its contractors have made every effort to be objective in the preparation and writing of the FEIS. Responsible opposing viewpoints have been considered in the analysis and resolutions of comments made on the DEIS. The individuals involved in its preparation are not all nonlocals; the engineering staff who designed the alternatives in the DEIS live in Salt Lake City and work for a firm (Dames & Moore) that has wide experience in the engineering of foundations for buildings in the Salt Lake Valley.

6.20.3 State Standards and Licensing

Three oral statements raised the issue of conformance to state standards in performing remedial actions on the Vitro pile. These comments can be summarized as follows:

- o The EPA standards are inadequate, as evidenced by their being less stringent than the state standards in such aspects as acceptable concentrations of heavy metals in ground water. Also, the stabilization in place alternative is equivalent in a number of respects to a sanitary landfill, and there too the local standards are much more stringent than the design for that alternative would imply. In such instances the DOE should conform to local rules and standards. (1, 15, 23)

Response.

The legislation that forms the basis for the DOE's Uranium Mill Tailings Remedial Action program (PL95-604) directs the DOE to take its remedial actions in conformance with regulations promulgated by the EPA and calls for the concurrence of the NRC and consultation with the affected state or Indian tribe. The final EPA regulations call for judgments about measures for the protection of surface and ground water to be made on a case-specific basis guided by relevant state and Federal water quality criteria.

6.20.4 Public Participation

The issue of public participation was raised in 1 letter and 3 oral statements. These comments, without response, may be summarized as follows:

- o The public hearings were conducted well and the opportunity for public participation was appreciated. (28, 39, and others)
- o How will the DOE respond to public comments? (37, 110)
- o "No matter how technically sound a solution may be, people will not accept a decision which is forced upon them without their being consulted." (39)

6.20.5 Private Profit

A number of persons at the hearings in Tooele spoke of the profit that would be made by persons in the Salt Lake Valley after the Vitro tailings are removed and the land is made available for other uses. One said, "give us the land they're going to make millions on," presumably in compensation for having to accept the tailings in Tooele County. (4, 14)

On the other hand, a person working for the Salt Lake County Commission was indignant that these persons should think that the Valley people were "greedily trying to build the tax base." (21)

Response.

These comments reflect a misunderstanding of the economics of what will happen if the tailings are moved to South Clive. The land belongs to a semipublic agency working for the public good, the Central Valley Water Reclamation Facility, and the direct profit will accrue to that agency to be reflected in lower tax rates (or more likely, a slower rate of increase of those rates) imposed on the people it serves. The indirect gain will come from such things as rise in the land values, but will also include a rise in public tax revenues.

6.20.6 Proper Use of Taxpayers' Money

A few people (in 1 written and 4 oral statements) said that money was being wasted on this project. These comments varied from the point of view that the risks do not warrant any action to the point of view that things could be done at a much smaller expense. (4, 22, 34, 53, 105)

Response.

The DOE believes that no action at all is indefensible, not only because the EPA standards would not be met, but also and more importantly because these tailings have been badly misused by having been taken away and used for fill material elsewhere. This lack of control would continue indefinitely if no action were taken.

The suggestions for reduction of cost are discussed above in Section 6.10.

6.20.7 Decision-Making Process

The question of how the final decision would be made was raised in 10 written and 14 oral comments. The comments are summarized below.

- o Several commenters felt that cost was being or would be used to justify the stabilization in place option, with health, safety, and environmental considerations being given a lower priority. "Cost should be of secondary importance." Decisions should not be forced upon people. (1, 6, 14, 20, 23, 33, 39, 45, 50, 53, 107, 110, 202, 206, 207) One person stated that DOE "has no authority to use cost as a justification for lesser environmental controls." (110)
- o On the other hand, one person wrote that stabilization in place meets the UMTRCA requirements for health, safety, and environmental protection; also the cost of stabilization in place, compared to the cost of relocation and disposal, bears a more reasonable relationship to any potential benefits which may be derived. (104)
- o The Governor and others said that the DOE will make the decision, but the state must concur, per the cooperative agreement between the DOE and the State of Utah. The governor said, "the Act anticipates a mutually satisfactory course of action through the implementation of a cooperative agreement. The implicit preference found in the draft EIS does not accomplish a mutually satisfactory resolution of the problem." The mayor of South Salt Lake said, "Should the Governor's and Department of Energy's decision for remedial action differ, the City of South Salt Lake and Salt Lake County will face the prolonged dilemma of no action being taken on a situation that jeopardizes the well-being of the entire community." (17, 109, 209, 213)
- o One person spoke of a "recent trend toward downplaying of health risks from dangerous wastes all over the country." (38)
- o Another citizen said that economic and social impacts should be studied, as well as environmental impacts. (39)
- o Social and economic impacts are addressed throughout this FEIS. The reader is referred to Sections 5.9 through 5.11 and Appendix I.
- o A Tooele resident told of a television news report (on March 22, 1983) which said the decision was already made to move the tailings to South Clive. (4)
- o Another Tooele resident expressed concern that surveys taken at the public hearings might play a part in the decision-making process. She was concerned lest sheer numbers would be a deciding factor. (13)
- o The purpose of the public hearing process is to solicit comments on the DEIS by the interested public as well as concerned agencies. The technical and environmental issues raised as a result of the hearing process are used as part of the decision process.

6.20.8 Manner of Response

The Southwest Research and Information Center (SRIC) of Albuquerque asked the DOE in its preparation of the FEIS to reproduce copies of all comments received on the DEIS in an appendix to the FEIS and to "address each specific comment and label its responses in the order they appear in the text of each commenter's statement." (110)

Response.

Altogether there were 79 oral and written sets of comments, as listed in Tables 6-1 and 6-2. The transcript of comments made orally is slightly over an inch thick and it is not practical to include the transcript in each copy of the FEIS; however, it is available in the numerous libraries and reading rooms listed at the beginning of Section 6.21. That section reproduces all written comments received.

Because of their number and because the same comments occurred repeatedly, the DOE is not responding to each comment separately, but, as this appendix shows, has responded to all comments by grouping together comments on the same subject and answering them collectively.

6.20.9 Other

A few other questions were raised in the public hearings (3 written and 7 oral statements) and are summarized below.

- o The Governor said, "DOE is responsible for actual acquisition of the 69 acres ((at the Vitro site if the tailings are to be stabilized in place)). The State of Utah recognizes its responsibility to pay 10 percent of all agreed upon costs, but will not undertake responsibility for actual acquisition of the realty in question." One of his advisors added the phrase, "if stabilization on site is the preferred alternative or final decision made by DOE." (209, 212)
- o The Governor and other state and local officials and residents said that the DOE was breaking past promises to move the tailings to a remote site. (21, 38, 48, 107, 209, 211, 212)
- o A few people mentioned that Tooele County did not create the tailings problem nor did it receive any economic benefits (e.g., taxes, jobs) from them. The tailings are a Salt Lake problem. (4, 8, 37, 201)
- o One woman said, "I have heard this called a Vitro Chemical Company. I want to know if my government stood behind the name of a chemical company and stacked that filthy stuff up for somebody else to clean up. Is that what happened?" She also wondered "why there is a company called Sakrete and a sand and gravel distributor right at the base of the Vitro site distributing things all over the city." (37)

Table 6-1. Index of Commentors at the DEIS Hearings

Statement index number ^a	Name	Affiliation	Hearing location ^b and page number in transcript
1	James O. Mason, M.D., Dr.P.H.	Utah Department of Health	T 13
2	Dr. Volney Wallace		T 22
3	Milo Higley		T 32
4	Vira Emerick		T 33
5	Y. Stanley Perkes		T 36
6	Joe Urbanik	Tooele County Development Services	T 40
7	Harvey Wright	Tooele City Council	T 48
8	Reed Russell	Tooele County Commission	T 51
9	Margaret Casper		T 54
10	Stanley R. Weyland		T 55
11	Beverly J. White	State Legislator	T 55
12	John Pliny		T 58
13	Bernice Russell		T 64
14	Jerron Atkins		T 66
1	Dr. James O. Mason	Executive Director, Utah Department of Health	S 11
15	Rodney L. Dahl	General Manager, Central Valley Water Reclamation Facility Board	S 20, 39
16	James Weaver	Consulting Economist for the Central Valley Board	S 32
17	James W. Davis	Mayor, South Salt Lake	S 43
18	Dr. Harry L. Gibbons	City-County Health Department	S 51
19	Terry Holtzworth	County Water Department	S 62
20	Wilford Black	State Senator	S 64
21	Scott Brown	Administrative Assistant, Salt Lake County Commission	S 67
22	Robert Church		S 74
23	Bart Barker	Salt Lake County Commission	S 81
24	Richard M. Taggart	South Salt Lake Chamber of Commerce	S 87
25	Michael R. Embley	West Valley City Council	S 90
26	Leslie Warner	Citizens United for Responsible Use of Taxpayers' Money	S 92
27	Zelpha Sweat		S 95
28	Margaret P. Lee		S 98
29	Devan Berrett	Sierra Door Corp.	S 100
30	T. Truman Cope		S 101
31	John Spear	Local 1645, National Transportation Union	S 102
32	Carl S. Anderson, P.E.		S 104
33	Richard W. Wells	Wells Distributing Co.	S 105
34	George L. Gygi	State Legislator	S 107
35	Lester D. Baker, P.E.	Baker Engineers	S 111
36	Linda Cahoon		S 116
37	Mae Thomas		S 119

Table 6-1 (cont.)

Statement index number ^a	Name	Affiliation	Hearing location ^b and page number in transcript
38	Frances Farley	Ex-State Senator	S 11
39	Gigi Brandt	League of Women Voters	S 16
40	Karl C. Dean		S 19
41	Jack Bratcher	Defenders of the Outdoor Heritage	S 24
42	B. Litzlower		S 25
43	George Bourne		S 29
44	Samuel S. Taylor	State Legislator	S 30
45	Udell Hill		S 33
46	Anthony Fischio	South Salt Lake City Council	S 34
47	Ruth H. Yates		S 36
48	Neff Peterson	Chairman, Central Valley Water Reclamation Facility Board	S 40
49	Edward B. Jackson		S 42
50	George Morrison		S 46
51	Jim Baker	Sierra Club	S 52
52	Sherry Adderly		S 54
53	Norman van Wagoner		S 55

Cross-Index to Table 6-1

52 Adderly	40 Dean	13 Russell, B.
32 Anderson	4 Emerick	8 Russell, R.
14 Atkins	25 Embley	31 Spear
51 Baker, J.	38 Farley	27 Sweat
35 Baker, L.	46 Fischio	24 Taggart
23 Barker	18 Gibbons	44 Taylor
29 Berrett	34 Gygi	37 Thomas
20 Black	3 Higley	6 Urbanik
43 Bourne	45 Hill	53 van Wagoner
39 Brandt	19 Holtzworth	2 Wallace
41 Bratcher	49 Jackson	26 Warner
21 Brown	28 Lee	16 Weaver
36 Cahoon	42 Litzlower	33 Wells
22 Church	1 Mason	10 Weyland
9 Casper	50 Morrison	11 White
30 Cope	5 Perkes	7 Wright
15 Dahl	48 Peterson	47 Yates
17 Davis	12 Pliny	

^aNumber code used in indexing the comments received.

^bKey to hearing location: T = Tooele, Utah, March 22, 1983;

S = South Salt Lake, Utah, March 23, 1983.

Table 6-2 Index of Persons Submitting Written Comments

Statement index number ^a	Name	Affiliation	Date of comment
101	Zettie M. Garcia	Citizen, Tooele, Utah	March 17
102	Karl C. Dean	Citizen, Salt Lake City	March 22
103	Custer L. Lynn	Citizen, Tooele, Utah	March 29
104	W. J. Shelley	Kerr-McGee, Oklahoma City	March 29
105	Marilynn W. Gianelo	Citizen, Salt Lake City	March 30
106	Evelyn Richards	Citizen, Park City, UT	April 7
107	Nanette Benowitz	League of Women Voters of Salt Lake	April 8
108	Lester D. Baker, P.E.	Baker Engineers, Ogden, UT	April 8
109	James W. Davis	Mayor, City of S. Salt Lake	April 8
110	Chris Shuey	Southwest Research & Information Center, Albuquerque, NM	April 11
111	Dr. Volney Wallace	Citizen, Tooele, Utah	April 18
201	Charles Stromberg et al.	Tooele County Commission	March 14
202	Harry L. Gibbons, M.D., M.P.H.	Salt Lake City-County Health Department	March 31
203	Bruce Blanchard	U.S. Department of the Interior Washington, DC	April 5
204	Steven J. Durham	U.S. Environmental Protection Agency, Denver, CO	April 6
205	John K. Cluff et al.	Tooele City Mayor and Council	April 6
206	Dan Marriott	Member of Congress Washington, DC	April 7
207	Rodney Dahl	General Manager, Central Valley Water Reclamation Facility	April 8
208	Wayne I. Baer	Salt Lake City-County Board of Health	April 7
209	Scott M. Matheson with 5 enclosures:	Governor of Utah	April 8
210	Nile Eatmon	Div. of Community Development	March 21
211	James O. Mason, M.D., Dr.P.H.	Utah Department of Health	January 19
212	Anonymous	(cost and other estimates)	March 29
213	Fred Nelson	Assistant Attorney General	March 21
214	William R. Lund	Utah Geological and Mineral Survey	March 25
215	John C. Villforth	National Center for Devices and Radiological Health, U.S. Public Health Service	April 22

^aNumber code used in indexing the comments received.

Table 6-3 Cross-Index of Commentors and Issues

Com- menters ^a	Issues ^b
1	3.1, 4.1, 5.2, 6.3, 6.5, 8.1, 8.2, 9.3, 9.5, 10.1, 10.2, 10.3, 20.1, 20.3, 20.7
2	9.8, 12.4, 13.4, 17.2, 20.1, 20.2
3	5.3, 11.4, 20.1
4	5.3, 7.3, 9.7, 10.1, 11.2, 20.1, 20.2, 20.5, 20.6, 20.7, 20.9
5	5.4, 8.7, 11.5, 13.5, 14.1, 20.1
6	6.1, 7.1, 7.2, 8.1, 9.1, 9.2, 10.1, 14.2, 14.3, 15.1, 16.1, 17.4, 20.1, 20.2, 20.7
7	13.7, 15.1, 17.1, 20.1
8	11.2, 15.1, 20.1, 20.9
9	17.1, 20.1
10	9.5, 20.1
11	5.3, 7.1, 9.2, 15.1, 20.1
12	5.4, 7.4, 9.5, 13.7, 17.1, 20.1
13	5.3, 11.2, 15.1, 20.1, 20.7
14	7.1, 20.1, 20.2, 20.5, 20.7
15	1.1, 2.3, 6.2, 6.5, 8.2, 9.3, 9.5, 10.1, 10.2, 10.3, 13.1, 20.1, 20.2, 20.3
16	1.1, 1.2, 2.2, 10.1, 10.2, 20.1
17	3.1, 4.1, 10.2, 10.3, 13.2, 13.3, 15.2, 17.2, 20.1, 20.2 20.7
18	2.4, 5.2, 6.1, 6.2, 9.1, 9.4, 9.5, 13.1, 14.2, 16.1, 20.1, 20.2
19	6.1, 6.2, 9.1, 9.5, 20.1
20	8.2, 11.4, 13.2, 14.1, 20.1, 20.7
21	5.2, 10.2, 11.1, 13.3, 15.2, 20.1, 20.5, 20.9
22	9.7, 10.7, 12.5, 14.1, 18.1, 20.1, 20.6
23	1.1, 1.2, 1.3, 6.1, 9.3, 9.5, 10.1, 10.2, 20.1, 20.2, 20.3, 20.7
24	2.2, 9.5, 20.1
25	10.2, 20.1
26	8.8, 20.1
27	11.4, 20.1
28	4.1, 9.5, 20.1, 20.4
29	4.2, 20.1
30	15.2, 20.1
31	14.1, 20.1
32	9.8, 11.5, 20.1
33	11.4, 15.2, 20.1, 20.7
34	4.1, 11.4, 14.1, 20.1, 20.6
35	5.4, 9.5, 10.1, 10.6, 20.1
36	4.1, 11.4, 17.2, 20.1

Table 6-3 (Cont.)

Com- menters ^a	Issues ^b
37	20.1, 20.9
38	5.2, 20.1, 20.7 20.9
39	2.7, 6.1, 6.2, 10.6, 20.1, 20.2, 20.4, 20.7
40	9.8, 11.2, 20.1
41	4.1, 5.3, 20.1, 20.2
42	5.3, 9.8, 20.1
43	11.4, 20.1
44	15.2, 20.1
45	20.1, 20.7
46	10.2, 15.2, 20.1
47	4.1, 5.3, 11.4, 15.2, 20.1
48	4.1, 5.2, 20.1, 20.9
49	11.4, 20.1
50	5.3, 9.7, 14.1, 20.1, 20.7
51	2.1, 6.1, 6.2, 20.1
52	11.4, 14.1, 20.1
53	15.2, 20.1, 20.6, 20.7
101	20.1
102	5.3, 9.8, 11.2, 20.1
103	9.8, 20.1
104	10.5, 11.2, 20.1, 20.7
105	4.1, 6.2, 9.5, 15.2, 20.1, 20.6
106	6.2, 20.1
107	5.2, 6.1, 6.2, 9.5, 10.2, 13.1, 20.1, 20.7, 20.9
108	5.4, 10.1, 10.4, 20.1
109	3.1, 4.1, 10.2, 13.2, 13.3, 15.2, 17.2, 20.1, 20.7
110	1.3, 2.4, 6.1, 6.2, 6.3, 6.4, 7.5, 7.7, 9.2, 9.5, 9.6, 9.9, 10.2, 10.5, 10.8, 11.1, 11.3, 11.5, 12.3, 13.1, 17.4, 19.1, 19.8, 20.1, 20.2, 20.7, 20.8
111	6.2, 9.5, 9.8, 12.4, 13.4, 20.1
201	11.2, 15.1, 20.1, 20.9
202	2.4, 6.1, 6.2, 6.3, 9.1, 9.4, 9.5, 14.2, 16.1, 20.1, 20.7
203	5.3, 5.4, 6.2, 6.3, 16.1, 20.1
204	2.4, 6.1, 6.2, 6.3, 6.5, 8.5, 9.1, 9.4, 9.8, 10.2, 11.3, 11.5, 12.1, 12.2, 13.1, 13.6, 14.3, 17.3, 19.2, 19.3, 19.4, 19.8, 20.1
205	10.5, 13.7, 17.1, 20.1

Table 6-3 (Cont.)

Com- menters ^a	Issues ^b
206	4.1, 6.2, 6.5, 8.1, 8.2, 9.5, 10.1, 10.2, 10.3, 11.1, 13.3, 20.1, 20.7
207	1.1, 2.4, 6.2, 6.5, 8.2, 9.5, 10.2, 13.1, 20.1, 20.7
208	9.5, 20.1
209	1.1, 1.2, 2.4, 3.1, 4.1, 5.2, 6.1, 6.2, 6.3, 6.5, 7.1, 8.3, 8.4, 8.5, 8.6, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.8, 10.1, 10.2, 10.3, 11.1, 11.5, 13.1, 13.2, 13.3, 13.7, 14.2, 19.5, 19.6, 19.7, 19.8, 20.1, 20.2, 20.7, 20.9
210	10.2, 10.3, 13.3, 20.1, 20.2
211	3.1, 5.2, 5.4, 6. , 8.2, 9.5, 10.1, 10.2, 10.3, 13.3, 20.1, 20.9
212	1.1, 2.4, 3.1, 5.2, 6.1, 6.2, 6.3, 8.1, 9.1, 9.4, 9.5, 9.6, 9.8, 10.1, 10.2, 10.3, 13.1, 14.2, 20.1, 20.9
213	1.1, 1.3, 3.1, 10.1, 20.7
214	6.4, 6.5, 7.2, 7.6, 8.3, 8.4, 8.5, 8.6, 9.1, 9.2, 9.6, 11.5, 19.5, 19.6,
215	2.4, 11.6, 16.1, 17.4,

^aNumber code used in indexing the comments received; Tables 6-1 and 6-2 show the number code assigned to each commentor.

^bIssues are identified by the section in which they appear and the order in which they appear in that section. For example, "9.4" refers to the fourth issue in Section 6.9.

6.21 LETTERS RECEIVED DURING THE COMMENT PERIOD
WRITTEN COMMENTS
ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR REMEDIAL ACTIONS ON THE VITRO SITE,
SOUTH SALT LAKE, UTAH

This section reproduces the written statements submitted on the draft environmental impact statement for remedial actions on the former Vitro Chemical Company site, South Salt Lake, Utah. Copies of all letters are available for public review at the following locations:

Freedom of Information Reading Room
Room 1E-190, Forrestal Building
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Tooele Public Library
47 East Vine
Tooele, UT 84074

Salt Lake County Library
209 East 400 South
Salt Lake City, UT 84411

Salt Lake County Library
2480 South State
Salt Lake City, UT 84115

University of Utah
Library Office
Salt Lake City, UT 84112

Brigham Young University
Harold B. Lee Library
University Hill
Provo, UT 84604

Albuquerque Operations Office
National Atomic Museum
Kirtland Air Force Base East
Albuquerque, NM 87115

Library
Chicago Operations Office
9800 South Cass Avenue
Argonne, IL 60639

Library
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

Library
Nevada Operations Office
2753 South Highland Drive
Las Vegas, NV 89114

Library
Oak Ridge Operations Office
Federal Building
Oak Ridge, TN 37830

Library
Richland Operations Office
Federal Building
Richland, WA 99352

Energy Resource Center
1333 Broadway
Oakland, CA 94612

Library
Savannah River Operations Office
Savannah River Plant
Aiken, SC 29801

Regional Energy/Environment Center
Denver Public Library
1357 Broadway
Denver, CO 80210

Tooele, Utah 84074
17 March 1983
882-1651

101

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24 MAY 1983

Project Manager
Uranium Mill Tailings
Albuquerque, N.M.

20.1 [I would like to voice an objection to the moving of ^{Mar 22} ~~poisonous~~ ^{tailings} ~~from Salt Lake to Tooele.~~ ^{11 44 '83}
When America dropped the first bomb on Japan she slapped herself on the back and boasted "that ended things in a hurry". Now we have learned the hard way that rather than ending things it was really "just the beginning".
In Tooele we are fighting to keep Vitro Tailings out of our back yard. Why? Because no one in Salt Lake or anywhere else in Utah wants the dust, the poison, the radiation and the death they represent.
The truly "hot potatoe" has arrived to haunt us all. The Nuclear age has spawned a monster more terrible than the story of Frankenstein, nothing but poison, death and lies to the people in America.
The stories about Di-Oxen, Love Canal, F.C.B. , Orange Agent all linked to Leaks, spills, blow-ups, tailings and water contamination are just beginning to surface. It is only the beginning of a greater horror.
Congress and some of the "War "Lords" say that we have to protect ourselves from a Nuclear Build-up from Russia. Ask the people in Pocatello, Idaho this morning if its Russia they are afraid of on March 22, 1983. They can tell you the horror they are facing this moment is not in Russia, but in their drinking faucets. The people in St. George, Utah can tell you that their nightmares all are buried in the cemeteries.
To clean up all the tailings, pits and leaks has been estimated at from ten billion to 40 billions of dollars.
Twenty years down the road with the present policy where is the cost going to stand?
America and its people need to get behind a "NUCLEAR FREEZE. To worry about tailings and the problems sure to come is a case of "Locking the Barn door after the horse has been stolen.

DONT PARK IT AMERICA STOP IT.....FREEZE THE NUCLEAR BUILD-UP

Sincerely

Zettie M. Garcia
Zettie M. Garcia

Ref: Tailing meeting in Tooele, Utah
to be held 22 March 1983

1901 E. 2990 S.
Salt Lake City, Utah 84106

22 March 1983

Mr. James A. Morley
Project Manager
Uranium Mill Tailings Project Office
U. S. Dept. of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

Lack of time has precluded a detailed study of the Draft Environmental Impact Statement entitled, "REMEDIAL ACTIONS AT THE FORMER VITRO CHEMICAL COMPANY SITE SOUTH SALT LAKE, SALT LAKE COUNTY, UTAH" and presentation of remarks at the public hearing on March 23. Nevertheless, a limited perusal of the document coupled with prior knowledge of reclamation efforts on Vitro, Durango, Grand Junction, Monticello, Rifle, Uravan and Tuba City waste accumulations prompts the following comments.

(1) Table 3.1 in the EIS indicates that according to the EPA remedial action is required if the EGR is greater than 0.02 mR/hr above background in dwellings; which, I assume, signifies almost constant contact. On page 80, 3rd para., it states that EGR levels range from 0.1 to 1.2 mR/hr on the pile, thru 45 microcentren at .1 mile from the edge of the pile to background levels at .6 mile from the pile. Thus, indicating that limited intermittent contact with the pile would not present a major health hazard and would still permit usage of the land for many purposes, even including that of installation of the new sewage plant directly on the pile without any reclamation taking place.

Likewise, Table 1-3 indicates that the population within 6 miles of the pile might sustain excess lung cancer deaths of 0.24/year if no action is taken and on page 16, 2nd para., other calculations indicate the potential to increase to 0.7 to 0.8 total cancers. Hence, in that the tailing has been there a minimum of 19 years there should have arisen a minimum new cancer deaths of (19 X .24 = 4.56 or 19 X .75 = 14.25) yet to my knowledge none can be directly attributable to the tailing. On the same page, para 1, it states: "Because about 44 lung cancers occur each year in that area (HEW, 1968), an increase of 1 cancer would be impossible to demonstrate conclusively". Studies on the incidence of lung cancer at mine faces, when correlated with smokers or non-smokers, indicates that smoking is a much greater problem than radon emissions. Perhaps, some of the money being proposed for translocation of the tailing, could be better spent in educating smokers that live within the affected area.

(2) Despite the above I do not recommend inaction on the waste pile but have some suggestions for implementation with alternatives 1 and 2 though, I unhesitatingly, support the alternative 2 concept of stabilization.

-2-

A. Test drilling now underway may definitely mandate a lining installation under the tailing to prevent seepage from the pile into nearby aquifers. However, based upon previous studies which indicate that even with high concentrations of acids the solubility of uranium is only about 64 percent we might expect that the amount of deleterious ions entering the aquifers to be quite low if only water percolation is involved. Perhaps, a far simpler, much less expensive, stabilization procedure can be suggested, specifically:

1. Reduce the tailing pile to grade for whatever ultimate intermittent use determined to be best-municipal refuse recycling plant, municipal incinerator, sewage plant extension, recreation site, or whatever.

2. Place a relatively thin layer (4") of sodium bentonite clay over the entire surface, cover this with a thicker layer (6-12") of sewage sludge, top with 2 feet of soil and plant to a desired vegetation. The entire cost probably will not exceed \$10,000 per acre and yet should achieve adequate stabilization while preventing contamination of the aquifers from downward water percolation, inhibiting the radon emissions through the constantly moist layer of bentonite, provide a site for root growth in the sewage sludge so that the roots won't penetrate the tailing proper and tend to transpire radon gas to the surface and reduce what little EGR there is to an even more acceptable amount.

(3) Should it be determined that movement of the pile is mandatory, another alternative to the Clive site is recommended. In that Kennecott produces about 100,000 tons/day of copper tailing, perhaps, the slurried Vitro tailing can be added to the large tonnage of copper tailing being discharged daily by the Kennecott mills to their 20 square mile tailing pond. Dilution of the emissions would be immediate and coverage would be achieved in a relatively short period of time.

A copy of my technical biography is enclosed to furnish information on my background.

Sincerely yours,

Karl C. Dean
Karl C. Dean

473 Pioneer Avenue
Tooele, Utah 84074

29 March 1983

Project Manager
Uranium Mill Tailings Project Office
Albuquerque Operations Office
U. S. Department of Energy
P. O. Box 5400
Albuquerque, New Mexico 87115

Dear Sir:

1. Reference is made to:

a. Draft Environmental Impact Statement, February 1983, U. S. Department of Energy, DOE/EIS - 0099D.

b. Public hearing conducted on March 22, 1983, at the Senior Citizens Center, Tooele, Utah to receive comments on the DEIS concerning slightly radioactive mill tailings and other materials from the Vitro mill tailings site at South Salt Lake City, Utah.

2. It is recommended that the 69 acre area at the Vitro site (see pages 28 + 29 of Draft Environmental Impact Statement, February 1983, U. S. Department of Energy) be covered with the following:

a. A 4 foot layer of 40 to 70 mesh (0.2 to 0.4 mm grain size) sand.

b. A 3 foot layer of crushed stone, $3 \frac{1}{2}$ inch to $1 \frac{1}{2}$ inch size.
(American Association of State Highway Officials Specification).

c. A 2 foot layer of crushed stone, $2 \frac{1}{2}$ inch to $1 \frac{1}{2}$ inch size.
(A.A.S.H.O. Specification).

d. Surface radioactivity should be determined and recorded after the placement of sand in 2a and after the placement of crushed stone in 2b and after the placement of crushed stone in 2c. A determination should then be made as to whether or not an additional layer of 2 feet or less of crushed stone, 2 inch to 1 inch size (A.A.S.H.O. Specification) is required.

3. There should be no placement of a clay layer on the surface of the 69 acre disposal area (see page 28 of Draft EIS).

4. An appropriate number of settlement platforms with gauges should be positioned properly to measure the extent of embankment settlement and elapsed time for settlement due to the placement of the sand and crushed stone in preceding paragraph 2. These measurements are to control the rate of placing the sand and the crushed stone and to avoid embankment shear. A curve showing settlement or consolidation versus time should be plotted.

5. Enclosed is an extract from "Soil Mechanics in Engineering Practice by Terzaghi and Peck." Your attention is invited to pages 400 and 401.

Yours truly,

Custer L. Lynn
Custer L. Lynn
Maj AUS Retired

473 Pioneer Avenue
Tooele, Utah 84074

29 March 1983

Project Manager
Uranium Mill Tailings Project Office
Albuquerque Operations Office
U. S. Department of Energy
P. O. Box 5400
Albuquerque, New Mexico 87115

Dear Sir:

For your information.

1. I have a B. S. in Chemical Engineering and retired February 1958 from the U. S. Army at Dugway Proving Ground, Utah.
2. I worked in the State of Utah Materials Laboratory, February 1958 to November 1960. Most of my work here was in the area of Soil Mechanics for the determination of settlement of embankments in the construction of highway overpasses.
3. During November 1960 to June 1976, I worked as Administrative Contracting Officer, GS-12, for the Department of The Air Force and The Department of The Navy on Research + Development and Production of rocket motors for Minuteman and Poseidon Missiles.

Yours truly,

Custer L. Lynn
Custer L. Lynn
Maj AUS Retired

The author enclosed "Soil Mechanics in Engineering Practice" by Terzaghi and Peck, pp. 398-406.

This document is available at the repositories listed in Section 6.21.



ENVIRONMENT AND HEALTH MANAGEMENT DIVISION

March 29, 1983

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13 APR 1983

Mr. James A. Morley
Project Manager
Uranium Mill Tailings Project Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Re: Draft Environmental Impact Statement: DOE/EIS-0099-D, Remedial Actions
at the Former Vitro Chemical Company Mill, South Salt Lake, Salt Lake
County, Utah (48 Fed. Reg. 7294, Feb. 18, 1983).

Dear Mr. Morley:

Kerr-McGee Corporation, Kerr-McGee Nuclear Corporation, and Kerr-McGee Chemical Corporation (hereinafter "Kerr-McGee") appreciate the opportunity to comment on the referenced draft environmental impact statement (DEIS) concerning the Vitro site. As discussed subsequently, Kerr-McGee recommends that the final environmental impact statement conclude that the contaminated materials be stabilized in place, i.e., that alternative 2 in the DEIS is the preferred alternative.

Interest and Relationship of Kerr-McGee

Kerr-McGee operates uranium mines, a uranium mill, and a uranium conversion facility. It previously operated other nuclear fuel cycle facilities and non-fuel cycle facilities, some of which are currently in the process of being decontaminated and decommissioned. In addition, it has operated and has participated in the operation with other entities of facilities at sites that have been designated for remedial action under the Uranium Mill Tailings Radiation Control Act of 1978, Public Law 95-604 (UMTRCA). Accordingly, both current and previous operations conducted by Kerr-McGee are related to the provisions and potential applications of the UMTRCA.

20.1 Stabilization in Place Is Recommended

20.7 Kerr-McGee recommends that, to the extent remedial action is undertaken at the Vitro site, it be consistent with alternative 2 of the DEIS -- stabilization in place on site. This is adequate to protect the public health against potential risk, is environmentally sound, and is in keeping with the "reasonable effort" approach stated by the Congress in enactment of UMTRCA.

James A. Morley
Page 2
March 29, 1983

a. Stabilization in Place Protects Public Health

The DEIS indicates, as do other analyses, that under the current conditions of the Vitro site, the potential health effects are quite small. The estimated effect due to inhalation of radon-daughters is less than one lung cancer case per year for the population of some 500,000 people. The risk due to external gamma radiation exposure or uptake of airborne particulates is much less. In all these instances, the estimated effects are hypothetical, upper limit and could well be zero.

11.2 Stabilization in place, as described in the DEIS, controls totally the potential for exposure to external gamma radiation, completely suppresses the potential for resuspension of radioactive particulates, and isolates the contaminated materials from the possibility of entering water systems. The radon emanation will be suppressed to essentially a level comparable to that which is normally extant as background literally within the boundary of the site. While the stabilization in place process recommended in the DEIS goes beyond what is necessary, the net effect will be the reduction of what currently is a negligible, but calculatable risk, to an even more de minimis risk that is far, far less than the risks commonly and ordinarily accepted in society.

b. Stabilization in Place Is Environmentally Sound

The DEIS clearly shows that stabilization in place is environmentally sound. This alternative has only minimal impact on air quality, water, ecosystems, transportation and other pertinent factors, all of which are short-term and a function of the remedial process. After the remedial action is completed, there will be no environmental consequences other than the restricted use of the land on which the contaminated materials have been stabilized. Since the site is zoned for industrial use, and since the use of the site is consistent with this zoning, the environmental consequence cannot be viewed as negative.

20.7 c. Stabilization in Place Is Consistent With the Congressional Intent

In enacting the UMTRCA, the Congress stated that "(E)very reasonable effort should be made to provide for the stabilization, disposal, and control in a safe and environmentally sound manner of such tailings in order to prevent or minimize radon diffusion into the environment and to prevent or minimize other environmental hazards ..." Stabilization in place meets this requirement in all aspects. Radon diffusion is minimized, water is protected and resuspension of materials is eliminated. The material is stabilized, disposed and controlled in a safe and environmentally sound manner. But an equally important consideration is that stabilization in place is reasonable, and its cost, compared to the cost for relocation and disposal, bears a more reasonable relationship to any potential benefits which may be derived.

James A. Morley
Page 3
March 29, 1983

10.5

There are both monetary and non-monetary costs associated with the proposed remedial action. Based on the DEIS analysis, stabilization in place costs approximately one-half the transportation costs alone if the material were relocated for disposal. The overall cost estimated for relocation and disposal is at least four times that estimated for stabilization in place. There are no off-setting benefits associated with moving the material. To the contrary, there would be additional non-monetary costs involved with relocation that are not associated with stabilization on site. Relocation requires a larger work force and increased handling of the material, thereby enhancing the likelihood of work-related serious injuries, up to and including fatalities.

Relocation can not be justified. The additional funds and the increased potential for serious injuries are tremendous costs and are unreasonable in view of the fact that relocation offers no improvement in public health and environmental benefit. These substantial costs clearly outweigh any potential benefits.

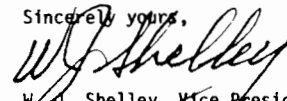
General Comment

Kerr-McGee recognizes there are perceptions that uranium tailings piles pose a significant public health threat and that this threat can only be averted by disposing of the tailings at remote, unoccupied locations. These perceptions are not supported by the analyses in the DEIS, nor are they supported by independent analyses done by authoritative scientists or other governmental agencies.

For example, the Environmental Protection Agency, in its analysis of potential health effects attributable to all the inactive uranium tailings piles, estimated about two fatal lung cancers per year for the U.S. population. These two cases would be in addition to the some 92,000 lung cancer fatalities that normally occur annually in the U.S. populations. By any measure, the two additional potential cases would be considered an insignificant risk compared to the overall risk.

Kerr-McGee believes it is most important that DOE, in determining the remedial action alternative for the Vitro site, base its judgement on factors such as the significance of the risk illustrated above, the benefits that will possibly be derived, the costs involved and other genuine issues. The judgements should not be dictated by what is deemed advisable to allay unsupported fears and erroneous perceptions.

Sincerely yours,



W. D. Shelley, Vice President
Nuclear Licensing and Regulations

es;dc

Marilynn W. Giamelo
1383 South 1900 East
Salt Lake City, Utah 84108

March 30, 1983

Mr. James A. Morley, Project Manager
Uranium Mill Tailings Project Office
U. S. Dept. of Energy
P. O. Box 5400
Albuquerque, NM 87115

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24 MAY 1983

Dear Mr. Morley:

- 20.1 [The following are my comments for inclusion in the Final Environmental Impact Statement for remedial action at South Salt Lake City or Clive, Utah. I very strongly oppose trying to stabilize the tailings in place at the Vitro site in South Salt Lake City, which is absurd.
- 15.2 [I have two reasons to be concerned. First and foremost is the fact that my children were brought up within six miles of the dump and we are aware that these children will later in life have a higher rate of cancer per hundred. How many more children have to fact this situation?
- 6.2 [The second concern centers around the possible contamination of the deep water aquifer below the dump site. I am well aware of the water problems facing the arid west. Our water situation in the Salt Lake Valley will become critical in the not too distant future. I worked for the Water Supply Forecast Center of the Weather Bureau until 1969, at which time there was increasing need to tap the aquifer.
- 9.5 [Additionally, please consider the fact that the technology for stabilizing the tailings in place is questionable. I believe that if we don't move the tailings now, no matter the cost, and stabilize in place, it may well become necessary in the future to remove them. This is not cost effective and that should be seriously considered. I am currently Secretary-Treasurer of A-G Body, Inc., and have had enough business experience to see the folly in not solving the problem once and for all.
- 4.1 [I am certainly more willing to pay taxes for the removal of the tailings than for putting the poorly conceived MX racetrack in our fragile desert area. Finally, haven't we studied this enough? I imagine the monies spent on studies could have paid for a good portion of the cost of removing the tailings?
- 20.6 [

Sincerely yours,

Marilynn W. Giamelo

Marilynn W. Giamelo

MAY 25 9 30 AM '83

To: DOE
 Re: Vitro uranium mill tailings

20.1 [The Vitro uranium mill tailings should be removed from the present site
 6.2 [because they are in a very populated area and also because the many wells in
 [the area could become contaminated.



LEAGUE OF WOMEN VOTERS OF SALT LAKE

8 April 1983

Program Manager
Uranium Mill Tailings Remedial Action Program
U.S. Department of Energy
Albuquerque Operations Office, Suite 1700
5301 Central Avenue, N.E.
Albuquerque, New Mexico 87108

RECEIVED
DOCUMENT CONTROL

25 APR 1983

Dear Sir:

The members of the League of Women Voters of Salt Lake have a strong interest in remedial action to remove the health hazard currently posed by uranium mill tailings at the Vitro site in south Salt Lake. We have studied the draft environmental impact statement (DEIS) comparing the effects of three proposed actions: (1) leaving the tailings as they are, (2) leaving them on site but stabilizing them by covering and possibly providing liners or slurry walls under and around them, and (3) moving them by train to be stabilized at a site 85 miles west, near Clive in Tooele County. League representatives have attended Department of Energy hearings in Salt Lake to listen and to present our criteria for choosing among these alternatives.

Alternative 1, no action, is clearly unacceptable to almost everyone.

The League's hazardous and radioactive waste disposal facility criteria state that sites should be avoided in areas of critical concern including:

- residential areas
- shoreslines of rivers, lakes and streams
- natural hazard areas subject to flooding, earthquakes, and subsidence
- drinking water supply sources, including aquifers and recharge areas

On the basis of these four criteria, we find the South Salt Lake site clearly inferior to the Clive site.

Other critical concern areas we wish to avoid are:

- prime agricultural, grazing and forest lands
- rare or valuable ecosystems or geologic formations, significant wildlife habitat, and unique scenic or historic areas

These two criteria would be more likely to argue against a location like Clive. But as far as we can determine they do not. Although there is grazing land in the area, it is marginal rather than prime in quality.

We recognize that in exceptional cases, areas of critical concern may not be avoidable and that protection can be engineered. However, in the South Salt Lake case, we see the following obstacles to that course of action. Local and state officials have criticized DOE analysis of current groundwater quality and flowpaths at this site, and we are pleased that

107

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Uranium Mill Tailings (DOE)

-2-

8 April 1983

your department has responded by addressing this concern. But there is reasonable doubt that additional data will be sufficient to satisfy local water and health officials by the time the decision point is reached. Although future uses of groundwater are not completely predictable, we believe from our previous study of Salt Lake water resources that an expected shortage of municipal water in the valley is very likely to lead to intensified use of groundwater. As noted in the DEIS and by commentators, the subsequent effects of intensified use on underground flows will increase the likelihood of contamination. Furthermore, we have very little reason to believe that the untried technology of clay liners and slurry walls (which are not even mandated, only suggested) would really prevent contamination, especially over the 1000 years required in an area of flood and earthquake danger. The addition of tons of soil cover weighty enough to prevent uneven ground subsidence (with probable subsequent liner cracks due to soil conditions at this site) would have adverse esthetic and cost features even if it worked.

Another reason to simply avoid this site rather than try to make it safe is that the Central Valley sewage treatment facility and the city of South Salt Lake have for many years expected the tailings to be moved. They have planned to use this site and surrounding area for purposes which will be of considerable benefit to them and the Salt Lake residents they serve. These purposes include more adequate and efficient sewage treatment, energy resource recovery, and economic development.

In sum we have serious doubts that safety at the South Salt Lake site can be satisfactorily engineered, and there seem to be only two reasons to even try to do so. One is cost, and the other is the rights and sensibilities of the citizens of Tooele County. Regarding cost, we have heard testimony from state and local officials that the Clive alternative should cost only \$10 million more than the South Salt Lake alternative, rather than \$38 million more as estimated by DOE, and we welcome DOE efforts to resolve this discrepancy. We believe total cost estimates certainly should include the costs to Central Valley users of modifying their plans, as well as the foregone benefits to South Salt Lake City of planned economic development. Whatever the outcome of current cost recalculations, cost should be of secondary importance compared to the health of present Salt Lake residents and the 15 to 20 future generations who will be affected by the remedial action taken.

As to effects on Tooele County residents, we feel confident that the remoteness of the Clive site from human populations, its hydrological conditions, and limited surface uses all argue against any adverse effects on local health, safety, water supply, or economic well-being. We believe any fears they may have on this score are unfounded. Nor do we think they should feel "stigmatized" as a "dump" site. We hope that they and the general public are beginning to realize that safe, suitable sites for hazardous and radioactive waste disposal are assets absolutely essential to the welfare of all of us. As citizens of Salt Lake, we will be very grateful to our Tooele neighbors for helping to provide a solution to this health problem which has plagued us for so many years.

Sincerely yours,

Nanette Benowitz
Nanette Benowitz
President

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108

8 April 83

Remedial Action Project Office
U.S. Dept. of Energy
5301 Central Ave., N.E., Suite 1700
Albuquerque, NM 87108

108

RE: Vitro Tailings - A FOURTH ALTERNATIVE

-2-

Dear Mr. Matthews:

Attached is our report regarding the proper action necessary to decontaminate the materials at the Vitro Site.

The Economic Evaluation (DOE/ALO-171) by Mountain States Research and Development was limited to studying the extraction of only three (3) products, namely: Uranium, Vanadium and Molybdenum. Leaching was the only method of extraction studied. We conditionally agree with their conclusion on page 3-1, that "it is not economic to reprocess the tailings at present market values for Uranium"; if Uranium, Vanadium and Molybdenum are the only marketable products to be considered; leaching is the only method of extraction, each of the products must be completely refined on site and the extraction of those three products has to show a clear profit.

We contend that:

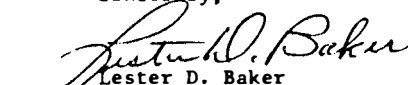
- 1) there are many other marketable products that can be concentrated from the tailings;
- 2) the products can be sold as concentrates without the high cost of a full process plant for refinement on site;
- 3) any recovery of marketable values can help offset the total cost of decontaminating the site;
- 4) there are available processes that can concentrate the heavy specific gravities and when used in combination with a flotation process and a bacterial leach treatment; can recover a much higher percentage of the values in high concentrations.

It would seem that the proper decision would be to: a) protect the public health, b) conserve public funds, c) save natural and commercial resources, d) preserve property values, e) protect the future generations from hazardous and financial burdens and f) protect public lands from contamination that will last thousands of years. All of these obligations can be met if the tailings are processed and decontaminated on site. We feel that this is the only alternative that will comply with those obligations.

20.1 [Processing the tailings on site would have the least cost, take the shortest time to process and could meet the standard permissible toxic levels. There is the possibility that at least part of the cost of processing could be refunded to the public coffers from market receipts.

We sincerely hope that this proposal will be considered and that the obligations to the public and future generations will prevail.

Sincerely,


Lester D. Baker
Registered Professional
Consulting Engineer

5.4

20.1

VITRO TAILINGS-
A FOURTH ALTERNATIVE

By: BAKER ENGINEERS

We believe that the EPA permissible standards for radioactive and toxic materials can be reached on all contaminated materials.

VITRO TAILINGS - A FOURTH ALTERNATIVE

AN ECONOMIC EVALUATION

of the

VITRO MILL TAILINGS

in

South Salt Lake City, Utah

for the

U.S. Dept. of ENERGY

by

BAKER ENGINEERS

6030 South 2400 East
Ogden, Utah, 84403

April 1983

* Utah, Idaho, Wyoming
and WashingtonPrepared by: *Lester D. Baker*
Lester D. Baker
*Registered Professional
Consulting Engineer

VITRO TAILINGS - A FOURTH ALTERNATIVE

INTRODUCTION:

We have reviewed the "Draft Environmental Impact Statement" (REIS) (DOE/EIS-0099-D) and the "Economic Evaluation of Inactive Uranium Mill Tailings" (Economic Evaluation) (UMTRA-DOE/ALO-171) by Mountain States Research and Development. We have copied two assays of the Vitro Tailings (see attachments Table C-1 and Table 5-A). Table C-1 is from EPA's "Final E.I.S. for Remedial Action Standards for Inactive Uranium Processing Sites" (EPA FINAL STDS) (EPA 520/4-82-013-1) and Table 5-A is from "Engineering Assessment of Inactive Uranium Mill Tailings (Engr Assessment) (DOE/UMT-0102) by Ford, Bacon & Davis, Utah, Inc.

We should note here that, try as we may, additional breakdown of the minerals in the tailings have been impossible to obtain.

CONCLUSIONS:

- 20.1 [From the above studies and what other information we can find, we feel that the Vitro Tailings can and should be processed and decontaminated on site.
- 10.1 [We have concluded that:
- 10.4 [1) Alternative 2 in the DEIS grossly underestimates the total cost of that remedy.
- 5.4 [2) Alternative 3 would cost more than 3 times the cost of reprocessing and decontaminating the tailings on site.
- 3) The assays in Tables C-1 and 5-A indicate that there are marketable products, if concentrated economically or uneconomically.
- 4) The radiation and toxicity can all be efficiently removed from the tailings, natural soil, process water, and ground water by the use bacterial bio-sorption. Numerous microbes, bacteria, cultures and fungi are available and each specialize in the uptake or adsorption of specific metals. They efficiently recover the values in solutions of less than 100 ppm, 50% or more of the uptake in the first 5 minutes. Some accumulate thousands of times higher concentrations than their environment. See attached studies.
- 5) There are available processes that can separate the heavy specific gravities and when used in combination with a flotation process and a bacterial leach treatment; can recover a much high percentage of the values in high concentrations.
- 6) The cost to concentrate all marketable, radioactive and toxic materials would be about \$33,000,000 and could easily be processed within a 2.5 year time frame.

JUSTIFICATION OF CONCLUSIONS:

1) Alternative 2 in the DEIS grossly underestimates the cost of that remedy by not including:

- a) cost of 5.4 acre tract with 4 buildings.
- b) cost of repair and maintenance of high volume, commercialized, arterial espressways used as haul roads.
- c) traffic accidents, hazards and delays due to the additional heavy truck traffic on busy city streets.
- d) removal of 60+ acres of prime commercial /industrial property from the tax roles.
- e) cost of treating the radioactive and toxic contaminated ground water.
- f) realistic haul distances. The type of clay for the liner may not be available in Salt Lake County.
- g) actual cost of Alternative 2 would be higher than the cost of reprocessing and decontaminating the tailings on site.

2) Alternative 3 in the DEIS does not include:

- a) costs of road repair and public losses incurred in hauling the million cubic yards of restoration materials to the Vitro Site. See points "b" and "c" of Alternative 2.
- b) same costs of hauling oversized, contaminated material to South Clive by truck.
- c) cost of treating the radioactive and toxic contaminated ground water at the Vitro Site.
- d) the burden placed on future generations in regards to safely, public health, financial obligations and another potential cost of contamination clean-up.
- e) the high initial cost and obligation that will continue forever should justify the processing and decontamination on site for less than one-third the amount.

3) EPA Final Stds and Engr Assessment assays (see attached Tables C-1 and 5-A) verify that there are many other marketable products that can be concentrated economically from the tailings.

4) There is some concern about the radiation from Radium, but we haven't found any information on the amount of Radium in the tailings. It isn't mentioned in either assay.

5) The Economic Evaluation study was limited to the extraction of only three (3) products, namely: Uranium, Vanadium and Molybdenum. None of these products show-up in the assays as having commercial values when extracted individually. When concentrated with other products, then separated as one of several concentrates, there is some commercial value.

The study evaluated several types of leaching, but limited their study to that one process. The chemical reagents (used in leaching) was estimated at over \$6,300,000 per year for 2.7 years totaling over \$17,000,000 of \$42,700,000 cost of processing. The market value of their products was only \$19,900,000.

Each product was fully processed to a marketable form in separate high volume plants. The plants were designed to process all the product in only 2.7 years. This is a major capital expenditure for a extremely short useful life.

The concentrates of nearly all of the minerals are marketable at existing plants that are already processing that product.

The cost of reagents used in bacterial leaching is much less since the microbes do most of the "work". The ph of the solutions used in most bacterial leaching range between 4 and 7.

6) According to the two assays (Tables C-1 and 5-A) some of the minerals that appear to have marketable quantities are:

Uranium	Nickel	Barium
Vanadium	Tin	Copper
Molybdenum	Titanium	Gold
Rubidium	Tungston	Silver
Gallium	Cobalt	Chromium

THE FOURTH ALTERNATIVE:

PROCESS:

We would propose 5 circuits, each capable of processing 100 to 120 tons per hour. Processing only 8-hours per day, they could process the 2 million tons of tailings in 500 working days.

Each circuit would have a Grizzley, Feeder Bin, Water Wash Plant (or Trummel), Recovery Sluice System with hydrostatic separators (for heavy specific gravities), Bio-sorption Extraction Cell (for removing radioactive and toxic materials in solution), Water Recovery System, Extended Flotation Cell (for mineral with low specific gravities), and another Water Recovery System.

The Tailing materials would be placed on a leach pad for bacterial leaching, then after neutralization, they would be mixed with cement or lime for final emplacement. The tails would solidify to a point where there should be no dusting, leaching or escape of radon gases if there is any.

All ground water would be processed through a bio-sorption cell to extract all radioactive and toxic materials in solution. The contaminated natural soil would also be leached with the bacteria.

The process could be monitored constantly at several points to confirm the amount of remaining radioactive and toxic materials.

Two of the sewage treatment tanks proposed for future expansion of the neighboring sewage treatment company could be built and used for water storage and treatment.

The processing could be flexible enough to allow for the programs of the sewage treatment facility.

ADVANTAGES:

THE FOURTH ALTERNATIVE would have the following advantages and almost none of the possible disadvantages of the other alternatives.

- 1) The radioactive and toxic materials can be concentrated economically and sold to the commercial market along with other concentrated values.
- 2) The contamination of air, ground and water would be limited to the present site, and not spread along the roads, railroad tracks, or deposited at a second site to be monitored forever.
- 3) No need for monitoring a contaminated site.
- 4) The contaminated ground water and process water can be "cleaned" by bio-sorption and the radiation and toxic levels can be reduced to "acceptable" levels.
- 5) The Tailings would be processed in a "wet" condition which would minimize any dusting.
- 6) The final placement and compaction would be as "soil-cement" allowing no dusting, leaching or escape of radon gases or radiation, if there should be any.
- 7) There would be no need for importing more than a million cubic yards of restoration material, cover material or clay and gravel liners.
- 8) No offsite impact including:
 - a) contamination of air, water or ground.
 - b) exposure to other residents or wild life.
 - c) damage to roads, railroads, etc.
 - d) traffic problems, accidents, delays.
 - e) use of natural resources, such as: gravel, clays, fuel, etc.
 - f) use of commercial resources, such as: trucks, roads, railroads, tracks, loaders, conveyors, etc.
 - g) monitoring of a disposal site forever.
 - h) use of public funds without a beneficial gain or improvement for the public.

PLANT COSTS

<u>ITEM</u>	<u>AMOUNT</u>
Site Preparation	\$500,000
Engineering	500,000
Material Handling & Loading Equipt.	2,500,000
Process Circuits (5 reqd @ \$800,000)	4,000,000
Separating and Handling Concentrates	1,000,000
Leach Equipment	1,000,000
Reagent & Chemical Storage	500,000
Reagent Process Equipment	1,500,000
Asphalt Leach Pads	2,000,000
Buildings	500,000
Water Tanks (future sewage tanks)	500,000
Plant Total	\$14,500,000

OPERATING COSTS

Admin. and Supr.	\$1,500,000
Operating Labor	4,500,000
Reagents and chemicals	2,500,000
Cement or Lime	1,500,000
Bacteria & Fungi	1,000,000
Supplies	500,000
Analytical Equipt. and Labor	800,000
Maintenance Supplies and Labor	700,000
Utilities	500,000
Overhead	500,000
Operating Total	\$14,000,000
Subtotal	\$28,300,000
15% Contingencies	\$4,300,000
PROJECT COST	\$32,800,000

The author of Comment 108 also provided the following information:

Table C-1. Elements present in tailings from acid-leach mills and in typical soil (EPA 520/4-82-013-1).

The Mechanism of Uranium Biosorption by *Rhizopus arrhizus*. Tsezos, M. and B. Volesky. From *Biotechnology and Bioengineering*, Vol. XXIII, pp. 583-604.

Table 5-1. Assay results of composite Vitro tailings samples.

Biosorption of Uranium and Thorium. Tsezos, M. and B. Volesky. From *Biotechnology and Bioengineering*, Vol. XXIII, pp. 583-604.

Radiation Degradation and the Subsequent Enzymatic Hydrolysis of Waste Paper. From *Biotechnology and Bioengineering*, Vol. XXIV, pp. 991-997

Sites of Metal Deposition in the Cell Wall of *Bacillus subtilis*.

Recovery of Heavy Metals by Microbes. Chiu, Y. 1972. Ph.D Thesis. University of Western Ontario, London, Ontario, Canada.

Bacterial Resistance to Toxic Metals Determined by Extrachromosomal R Factors. Silver, S., Schottel, J., and A. Weiss.

Approaches to the Study of Microbial Transformations of Metals. Brinckman, F.E., Iverson, W.P., and W. Blair.

Biodegradation of Chalcopryrite. A.E. Torma.

The Assimilation of Trace Metal Ions by the Marine Bacteria, *Arthrobacter marinus* and *Pseudomonas cuprodurans*. Jones, G.E., Royle, L.G., and L. Murray.

These documents are available at the repositories listed in Section 6.21.

JAMES W. DAVIS
MAYOR
COUNCILMEN
BONNIE T. FARNSWORTH
RANDALL G. FITTS
HOWARD C. MOORE
GARY W. SESSIONS
ANTHONY F. FISCHIO

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109

WM. W. ANDERTON
DIRECTOR
PUBLIC WORKS
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VAL W. BESS
CHIEF OF POLICE
NOEL F. ERICSON
STREETS
BETH M. JENSEN
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19 APR 1983

ACTIONS FOR THE VITRO TAILINGS

WRITTEN COMMENTS

BY

JAMES W. DAVIS

MAYOR

CITY OF

SOUTH SALT LAKE

APRIL 8, 1983

109

I am James W. Davis, Mayor of the City of South Salt Lake. I am the Past President of the Salt Lake County Council of Governments, Past Chairman of the Wasatch Front Regional Council, Past Chairman of the Central Valley Water Reclamation Board, and a member of the Salt Lake City-County Board of Health, as well as a member of the Governor's Uranium Mill Tailings Task Force.

I am extremely concerned about the outcome of the uranium mill tailings at the Vitro site, which is located within my City's boundaries. My commitment to the residents of the City of South Salt Lake is to see that the tailings be moved to an environmentally acceptable remote site.

The central purpose of my remarks today is to discuss with you the three alternatives listed in the Department of Energy Environmental Impact Statement and their affect on the well being of the South Salt Lake Community.

Before that discussion can take place it is important that you understand the nature of this community and its people. The City of South Salt Lake was incorporated in 1938 and has since then provided all essential services to its 10,500 residents on a continuing basis.

The approximate five square mile city is located in the economic and transportation center of the Salt Lake Valley. The two major freeways serving the Rocky Mountain West I-15 and I-80 cross in the center of our City and the three major regional railroads pass through our boundaries. Stretching from 2100 South on the North to 3300 South on the South and from the center of the Jordan River (1400 West) to our irregular border along 500 and 700 East, the City occupies the favorable position of being Utah's "Center of Industry". Our City provides approximately 1/8 of the jobs for the people of the State of Utah; 40,000 jobs by recent estimates. The community is also the showcase of quality industrial parks within the State.

Because we are located in the center of the vast Wasatch Front and tucked so neatly away in Salt Lake County, our presence plus the importance and flavor of our productive lifestyle gets lost by events that surround us.

I represent a community as separate and diverse in nature as any in Utah or the United States. We enjoy geographical integrity and financial security based on our own enterprise and activity. Don't be fooled because we blend our borders with other communities, we are as distinct and unique as Cedar City, Moab or Price. The only difference is that while they may be surrounded by farms and open space, we are surrounded by other cities.

The 10,500 people living in our City plus the 40,000 working here and the 180,000 travelling our surface streets, depend upon our City for essential services and protection while they are within our borders. Our 1979 Master Plan indicates that our City has one of the State's highest percentages of resident senior citizens and overall our residents have some of the lowest average annual incomes in Utah.

The economic importance of the land beneath the Vitro Tailings is important to all the people of the State of Utah; but of the highest value to the people who live and work within the boundaries of this community, the City of South Salt Lake.

Now that we have discussed the nature of my community, I would like to discuss with you the impact of Vitro on this City. I believe that if South Salt Lake was able to trade geographical location with Cedar City the problem of Vitro would be more easily understood.

Suppose we could take the freeway into South Salt Lake in that type of geographical isolation. The first thing you would notice as we come to the crest of the hill from the South is the 3300 South freeway exit. Off to the right of the exit is the Vitro site. On one of the cities highest valued parcels of ground is an area encompassing 69 acres which represents 6% of the total 3,700 acres of the City. This property sits idle instead of supplying services to the traveler, jobs to the City resident, or paying for itself in tax revenue. No, worse than idle, the site is blighted. No, worse than blighted, it is contaminated. The eyesore and menace of Vitro is that it has not only remained undeveloped itself, but adjacent property owners have been forced to abandon condemned properties. Vacant fields sporting price tags of more than \$193,000 per acre sit empty within 1/2 mile of the site because their value can't be realized on the open market. Plus the people throughout the entire area are caught in a continual time warp; listening while State, local and federal health and nuclear experts vacillate on whether or not the area is safe. For nearly 30 years the Vitro health question has dangled precariously over our head. Sometimes a threat to our health, sometimes harmless. The only thing certain is that every five to ten years someone in Washington, Denver or Albuquerque is going to come to town with a new set of criteria to either soothe us or alarm us. If any alternative but complete removal is accepted this cycle of indecision will continue to haunt this community and our grandchildren beyond the fiftieth generation.

109

109

I am also very concerned as I remember a statement extracted from the Utah State and Department of Energy Cooperative Agreement which indicates that Governor Scott M. Matheson must concur with the remedial action decided upon for the Vitro tailings. I quote "The detailed description of the work to be performed will be contained in a written Remedial Action Plan which will be developed by the DOE and the State. The Remedial Action Plan will be attached as appendices to this agreement, after having been approved by DOE and the State." The Governor has gone on record supporting removal of the Vitro tailings from their present location. Should the Governor's and Department of Energy's decision for remedial action differ, the City of South Salt Lake and Salt Lake County will face the prolonged dilemma of no action being taken on a situation that jeopardizes the well being of the entire community. It is imperative that the correct solution, satisfactory to those affected, be reached and remedial action started so all can be protected.

Obviously we're not expert enough to judge the health ramifications but by the Department of Energy's own assessment in the Environmental Impact Statement the land can't be safely used or left in its current accessible state unmonitored. Therefore, we are left to conclude that it is potentially harmful and must be permanently removed from its present location.

Capital Investment

Now let us discuss briefly other effects of Vitro on our isolated South Salt Lake model. The Utah State Division of Community Development states in their March 21, 1983 written testimony that the economic effect on South Salt Lake City is as follows:

Lost potential revenues over a 30-year period beginning this year, \$226,789 in the first year to \$270,185 per year in the 30th year,

Including:

Sales Tax \$33,750 - 97,376

Business Licenses \$8,250 - 22,750

Water Service \$162,720 - 320,780

Sewer Service Fees \$113,364 - 225,484

Gross Revenue \$284,334 - 567,014

Cumulative Discounted Revenues \$284,334 - 6,116,317

I believe it is clear that the people of my community are being harmed economically, socially and emotionally by the presence of Vitro chemicals tailing pile.

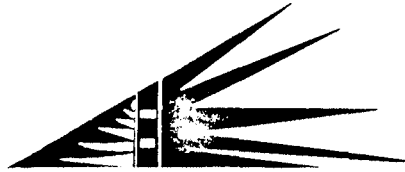
Now suppose that during the next 30 years the Department of Energy were to accept the option of moving the tailings away from this community and we were able to develop the land to its highest and best use. The 1979 South Salt Lake Master Plan envisions the eventual expansion of our 900 West business Industrial Park onto the Vitro properties. If the Department of Energy were to enable this to happen the following capital investment could occur over a 21-year period.

Year	Number of Developed Acres	Capital Invest.	Additional Econ Activ Generated	Gross Invest Impact	Cumulative Discont Econ Impact
1	35.0	\$172,959,040	\$242,142,656	\$415,101,696	\$415,101,696
2	36.7	1,450,234	2,030,328	3,480,562	418,385,245
3	38.4	2,072,751	3,549,859	3,549,859	421,444,607
4	40.1	1,508,877	2,112,427	3,621,304	424,485,124
5	41.8	1,539,090	2,154,726	3,693,816	427,410,972
6	43.5	1,569,747	2,197,646	3,767,393	430,226,187
7	45.2	1,601,293	2,241,811	3,843,104	432,935,423
8	46.9	1,633,284	2,286,597	3,919,881	435,542,368
9	48.6	1,666,163	2,332,628	3,998,791	438,051,259
10	50.3	1,699,486	2,379,280	4,078,766	440,465,474
11	52.0	1,733,253	2,426,555	4,159,808	442,788,289
12	53.7	1,767,909	2,475,073	4,242,982	445,023,439
13	55.4	1,803,454	2,524,836	4,328,290	447,174,467
14	57.1	1,839,443	2,575,221	4,414,664	449,244,234
15	58.8	1,876,321	2,626,850	4,503,171	451,235,991
16	60.5	1,913,643	2,679,100	4,592,743	453,152,382
17	62.2	1,951,854	2,732,595	4,684,449	455,107,039
18	63.9	1,990,953	2,787,334	4,778,287	456,881,525
19	65.6	2,030,941	2,843,317	4,874,258	458,589,191
20	67.3	2,071,818	2,900,545	4,972,363	460,232,622
21	69.0	2,113,138	2,958,394	5,071,532	461,813,950

In a 30-year period, the removal of the Vitro mill tailings could mean to our community over 900 jobs and the cumulative wages of workers of \$142,602,954 which serves to strengthen the economic health of the City, County and State.

The importance to my town of moving Vitro is my foremost concern at this hearing. The alternative of doing nothing is out of the question. Alternative #2 of stabilizing in place is equally out of the question unless the Department of Energy is willing to compensate the City, School District, County and State for the loss of potential revenue and community economic strength should the area have been allowed to develop.

20.1 [The removal of the tailings to an off-site location
is in my judgment the only reasonable possibility.
We respectfully urge you to remove the Vitro
contamination from our worries, from our health, from our
pocketbooks and most important from our future.


SOUTHWEST RESEARCH AND INFORMATION CENTER

April 11, 1983

Mr. James A. Morley, Program Manager
 Uranium Mill Tailings Remedial Action Project
 U.S. Department of Energy
 Albuquerque Operations Office
 5301 Central Ave., NE, Suite 1700
 Albuquerque, NM 87108

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25 APR 1983

RE: Southwest Research and Information Center Comments on
 Draft Environmental Impact Statement, "Remedial Actions
 at the Former Vitro Chemical Company Site, South Salt
 Lake, Salt Lake County, Utah"

Dear Mr. Morley:

Enclosed please find comments submitted on behalf of Southwest Research and Information Center (SRIC) on the Draft Environmental Impact Statement for remedial action at the former Vitro Chemical Co. abandoned uranium mill tailings site in South Salt Lake, Utah.

20.1 [For the reasons set forth in the attached comments, SRIC supports Alternative No. 3, relocation and stabilization of the Vitro tailings at the South Clive site in Tooele County with the design alternative incorporating at least 6 feet of cover material and, at the minimum, a 2-foot clay liner to protect groundwater resources in the area. This recommendation is cognizant of concerns of residents of Tooele County to the transportation of radioactive materials by railroad across their lands. SRIC recommends that the Department of Energy heed these concerns and take every reasonable precaution to prevent the leakage or spillage of tailings or contaminated materials and liquids in the transportation corridor.

20.8 [SRIC hereby requests that in its preparation of the Final Environment Impact Statement, DOE reproduce copies of all comments received on the DEIS and incorporate these reproductions as an appendix to the FEIS. DOE should address each specific comment and label its responses in the order they appear in the text of each commenter's statement. For an example of this method of response, DOE should refer to the U.S. Bureau of Land Management's Final Environmental Impact Statement on the Prototype Oil Shale Leasing Program, January 1983.

Sincerely,

Chris Shuey
 Chris Shuey
 Research Associate

Southwest Research and Information Center
 COMMENTS ON

Draft Environmental Impact Statement
 REMEDIAL ACTIONS AT THE FORMER VITRO CHEMICAL COMPANY SITE,
 SOUTH SALT LAKE, SALT LAKE COUNTY, UTAH
 (U.S. Department of Energy)

GENERAL COMMENTS

Objectives and Goals of Remedial Action

The Introduction to Section 3, Alternatives For the Remedial Action (page 19), states that the "objective" of UMTRAP (Uranium Mill Tailings Remedial Action Program) is "to combine at one location the radioactive materials, the contaminated soils, and the other contaminated materials from the site and the vicinity properties. . . ." to minimize "potential health effects caused by exposure to the tailings. . ."

While this is a reasonable objective for remedial action at the Vitro site and all other UMTRAP sites, SRIC believes that the larger goal or objective of remedial action at inactive uranium mill tailings sites is stabilization and disposal to protect people and the environment for the long-term period (thousands of years) that the substances in the tailings and related contaminated material will remain hazardous.

9.5 [In adopting the Uranium Mill Tailings Radiation Control Act of 1978 (P.L. 95-604), the legislation which authorizes remedial action at inactive tailings sites, Congress intended that long-term control of tailings be of paramount importance. The committee report accompanying the Act said:

9.5

The committee believes that uranium mill tailings should be treated [consistent] with the substantial hazard they will present until long after existing institutions can be expected to last in their present form. . . . The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time. (House Report No. 95-1480, Pt. 1, p. 17, and Pt. II, p. 40; 1978)

Remedial Action Goals and Objectives in the Context of EPA's Standards

The committee's language was an affirmative statement of Congress's intent that stabilization and disposal of hazardous uranium tailings be designed to endure the disruptive forces of wind and water and the potential disposition of tailings by humans for as long as the tailings remain hazardous. To accomplish this goal, the U.S. Nuclear Regulatory Commission set a tailings-control "longevity period" of at least 1,000 years (NRC, 1980). The U.S. Environmental Protection Agency proposed a similar longevity requirement (EPA, 1981). As of January 5, 1983, EPA revised this requirement to ensure that control measures "will last. . . up to 1,000 years and, in any case, for a minimum of 200 years" (EPA, 1983; page 598). In each of these regulatory actions, longevity of control and minimization of long-term maintenance and surveillance were keystones to effective remedial action.

In adopting its final longevity standard, EPA specifically noted that the low-end of the longevity range was intended only to guide implementing agencies where uncertainties clearly made control up to 1,000 years

impracticable (EPA, 1983; page 597). Otherwise, EPA affirmatively rejected institutional controls (such as fencing only and prolonged surveillance) in favor of "passive" engineering controls with the overriding goal of control for up to 1,000 years (EPA, 1983; page 597).

The final inactive-site standards authorize DOE as the implementing

agency to conduct remedial action to control inactive tailings for as long as practicable, up to 1,000 years. Consequently, DOE's stabilization and disposal options must consider the practicability of long-term control and offer as alternatives for the proposed action engineering designs that will result in protection of the public and environment for up to 1,000 years.

Implementation of a Preferred Alternative

20.1 SRIC believes that Alternative 3 of this DEIS best meets the authority granted DOE and the long-term control mandated by EPA's inactive-site environmental standards and should be implemented as the preferred alternative for remedial action at the South Salt Lake, Utah, site.

Benefits of Alternative 3

Control and Longevity. One of three preliminary design options for Alternative 3 calls for 1) partial below-grade disposal, 2) a 4-foot clay liner (Sec. A.5.2.2., page A-65), and 3) a 6-foot cover (including a 2-foot clay cap). If implemented, this design will reduce seepage of toxic materials to groundwater and mitigate to the greatest extent of any of the three alternatives considered by the DEIS surface disruption of the tailings by natural and human forces. Radon diffusion would be reduced to near background release rates (assumed to be 1 to 2 pCi/m²-sec [Sec. F-2.1.2, page F-46]) by the proposed cover design of Alternative 3 (Sec. A.5.2.3., page A-65; Figure A-27, page A-68) and surface runoff would be directed away from the stabilized impoundment by a riprap-lined diversion ditch (Fig. A-34, page A-86).

These controls will provide protection for up to 1,000 years as envisioned by the EPA standards and Congress's intent for long-term disposal.

Acquisition of the South Clive site by DOE with limited, periodic maintenance of the site and fencing to prevent access (controls which NRC may require through its statutory licensing authority [P.L. 95-604, Sec. 104]) will provide further assurance that the final disposal site will meet the 1,000-year stabilization objective.

Population Exposure. Implementation of Alternative 3 will remove a serious radiological hazard from the Salt Lake City area thereby eliminating the unnecessary and undemocratic excess radiation exposure of approximately 440,000 people (Tables 1-1 and 1-2, pages 6-7; Tables 5.1 and 5.2, pages 108-109). Disposal and stabilization at South Clive will be far removed from major population centers and at least 35 miles from the nearest community (Grantsville). Table 4-7 (page 92) shows that only 7 individuals live within 15 to 20 miles of the South Clive site. Stabilization at South Clive will eliminate excess external (gamma) and internal (alpha) radiation doses to Salt Lake City residents after remedial action, thereby eliminating 0.24 excess lung cancer deaths per year within 6 kilometers of the Vitro site (Table 1-3, page 12).

Land Use. Decontamination of the Vitro site will clear the entire 128 acres of hazards and allow the Central Valley Water Reclamation Facility (CVWRF) Board to proceed with the planned expansion of its existing wastewater treatment facility (Sec. 3.2.4.7, page 42). Removal of the tailings from the Vitro site not only will increase property values in the area, but allow South Salt Lake and Salt Lake City to improve existing wastewater treatment facilities thereby protecting their citizens from another significant source of groundwater contamination.

Economics. Relocation of the tailings to the South Clive disposal site

will create more jobs than stabilization in place at the Vitro site (Tables 1-1 and Table 1-2, pages 6-7; Sec. 5.11, pages 133-135). While the economic gains from remote disposal will be small compared to the existing economies of Salt Lake and Tooele counties, they nonetheless will aid in the easing of growing employment problems without attracting a large immigration of new residents and concomitant strain on existing services.

Cost. The estimated cost of disposal at the South Clive site exceeds that of stabilization at the Vitro site by three to five times, depending on the type of seepage control measure that would be adopted for the stabilization-in-place alternative (Sec. A.5.4.5, Table A-26; pages A-90 to A-91). However, the benefits to be gained from disposal at South Clive far outweigh the extra cost of remote stabilization. Only a few of these benefits are outlined in the comments above; others are discussed below in SRIC's specific comments on Alternative 3. Many advantages and benefits of remote stabilization are addressed in the DEIS, including the elimination of potential contamination of municipal groundwater supplies (shallow and deep aquifers) in a growing industrial area of South Salt Lake.

Additionally, SRIC believes that stabilization in place at the existing Vitro site may make compliance with EPA's environmental standards difficult. Stabilization at Vitro may not afford the 1,000 years of protection envisioned by the standards, especially if a seepage-control liner is not incorporated in the final design or less than 6 feet of cover (including an initial clay cap) is emplaced on the contaminated materials. The preliminary stabilization-in-place design contemplates 25 feet of material above grade; the resulting mound (with tailings and contaminated material 19 feet above grade) will be subject to wind and water erosion and potential earlier disruption of engineered

control features by human access to the site.

Concerns of Tooele County Residents

Tooele County residents have expressed concern that the disposal of uranium wastes at South Clive will needlessly expose lands and people to excessive levels of radiation through surface disturbance of the tailings or accidents involving the release of tailings in the railroad transportation corridor (see the transcripts of public hearings held in Salt Lake City and Tooele, Utah, on March 22 and 23, 1983).

These concerns are well-founded. While the DEIS documents the effects of such occurrences (see Appendix F and Sec. 5 of the text), DOE should make every possible effort to ensure that transportation accidents and disruption of the tailings will not occur. The Alternative 3 option described above -- remote disposal at South Clive with at least 6 feet of cover material and additional riprapping -- provides the greatest assurance that the people and lands of Tooele County are adequately protected. Its implementation can be carried out safely if certain extra precautionary measures are taken. Some of these measures are described below.

9.9

The tailings should be stabilized below grade (yet above the regional water table) and the site fenced following stabilization as envisioned by Sec. 3.2.4.5, page 40. The site should be posted with radiation warning signs and all DOE access roads and railroad spurs should be removed. All use of lands within one-half mile of the stabilized site should be prohibited. The federal government will take possession of the reclaimed site, thereby owning or controlling all lands within a 10-mile radius of the site (Sec. 5.15, page 138). Existing uses of the land for recreational vehicles and limited grazing

9.9 can be replaced by allowing those uses on other, nearby federal lands (Sec. 5.6, page 125).

Transportation of tailings should be governed by strict adherence to the American Association of Railroads restrictions on the transport of radioactive materials (Sec. A.5.4.2, page A-79), including the requirement of sealing all cars during transport of tailings and washing down the interiors of all cars after the unloading of each shipment. DOE should investigate reducing the average train speed of 10 miles per hour (Sec. 5.1.3, page 106) to reduce the potential for an accident that could release tailings to the environment inside the transportation corridor. Additionally, railroad schedules should be adjusted so that the one daily shipment of tailings to the South Clive site is conducted during hours of least vehicle movement on Interstate 80, including those hours when school buses are not loading or unloading children at rural locations within the transportation corridor.

Officials of Tooele County and the cities of Grantsville and Tooele should be kept regularly updated by DOE project managers and their contractors on the pace of remedial action at Vitro and the transportation of tailings. Open and frequent communication with local officials and residents and an ear toward their concerns will enable DOE to identify problems before they arise.

Strengths of the DEIS

The Department of Energy should be praised for compiling a document that is well organized, generally well edited and adequately referenced. Outside of the areas noted below under "Weaknesses," most of the conclusions were well supported with facts and analyses. Areas where the data was lacking or unknown were clearly identified as such. The appendices were particularly helpful in

assessing the three alternatives proposed in the text and in evaluating the other sites that were proposed by the State of Utah but rejected by DOE as possible disposal sites. The appendices also served to satisfy the requirements of the National Environmental Policy Act and the regulations of the President's Council on Environmental Quality.

Weaknesses of the DEIS

Language. Despite its strengths, however, the DEIS was weak in several areas. The first was in language. Very few members of the public without a background in uranium mill tailings management and radiation control would have difficulty understanding the terminology and analyses, especially those in the Appendices. While it is understandably difficult for DOE to use non-technical language, more effort should have been given to explaining concepts and technical "jargon". This could have been done in a section of the Summary or as a special preface to the DEIS. The Glossary and List of Acronyms which follow Section 5 aided in this respect, but were not well referenced in the text. DOE might consider upgrading the text to include more references to these lists.

Cover Requirement Analysis. In various parts of Section 5 and Appendix A reference was made to the amount of cover needed to protect the tailings from water and water erosion and human disruption. Several tables, including those cited above in the "Benefits of Alternative 3" section of these comments, gave graphic explanations to the text. However, no mathematical calculations were given using the NRC's radon emanation formula in Appendix P of NUREG-0706 (NRC, 1980) for determination of cover requirements in either Secs. A.4.2.3 or A. 5.2.3 (stabilization in place and South Clive, respectively). Additionally,

the discussion on soil-moisture content in Sec. A.4.2.3 was not detailed enough to inform the public of the significance that the moisture content of soils plays in designing an adequate cover. The NRC has noted that research has identified "moisture content as the key quality governing radon attenuation" (NRC, 1980; page 9-25).

Radiation Dose Analysis. SRIC is supporting the most conservative preliminary design option for Alternative 3 (stabilization with a 4-foot clay liner, 2-foot clay cap and 4 additional feet of cover including compacted granular outer layer and possible riprapping) not only to guarantee that up to 1,000 years of protection will be assured following remedial action, but also to act as a buffer against what may be an underestimation of the health effects of exposure to radioactive materials in the tailings.

The health effects of the three proposed alternatives are presented in Tables 5.1 and 5.2, pages 108-109. These effects, especially those from chronic exposure to Alternative 1 (No Action), may have been underestimated because DOE considered only lung cancer deaths from exposure to radon-222 and its progeny and other cancers from exposure to gamma radiation. DOE ignored other significant health effects known to be caused by radiation and computed dose commitments from various exposure sources only for healthy, adult members of the populations. These deficiencies are discussed briefly in the following paragraphs and in more detail in the Specific Comments section which follows these General Comments.

Uranium-decay series radiation (predominantly alpha particles) has been connected to a wide range of nonmalignant respiratory diseases (see, for example, Archer, 1976, and Wagoner, 1980). Some preliminary studies suggest that genetic effects have resulted in communities near active and inactive

uranium activities (Weiss, 1981). A compilation of the known and suspected health hazards of uranium activities is presented in an SRIC draft report (Taylor, 1983), which is attached hereto as Appendix 1.

Potential radiation harm to humans historically has been calculated on the basis of models which assume that only adults are exposed. Children, and particularly the developing fetus, are known to be more susceptible to the effects of ionizing radiation. Consequently, any radiation dose models which do not take into account the greater susceptibility of certain members of the population may have underestimated the cumulative radiation effects on the local population. Table F-21 of Appendix F of the DEIS indicates that DOE only estimated doses before, during and after remedial action at Vitro to adult members of the local population.

In the FEIS, DOE should address these considerations. DOE also should discuss the potential genetic effects of the alternatives considered in the DEIS and the possibility that doses and health effects were underestimated by the use of radiation models which predict harm only to healthy adults.

SPECIFIC COMMENTS ON ALTERNATIVE 3

The following comments pertain to specific statements in the DEIS concerning Alternative 3 or generic matters which indirectly pertain to Alternative 3, relocation of the Vitro tailings to the South Clive site. These comments also why Alternative 2 should be rejected as the preferred method of disposing of the Vitro tailings. The comments are arranged in order of page number and are identified as such.

Sec. 3.1.4, page 23

DOE was correct in pointing out the uncertainty involved in predicting seepage from the design alternatives. Its plan to conduct a detailed, two-phase geohydrologic investigation of the Vitro site is prudent. However, the anticipated groundwater study, which is designed to determine "the effectiveness of the less-expensive seepage-control options," may significantly change the conceptual design of Alternative 2 making stabilization in place more attractive economically than any option under Alternative 3. Several matters arise from the undertaking of such a study.

First, DOE implies that cost is a statutory or regulatory objective in remedial action. SRIC is aware of DOE's intent to reduce costs of the UMTRA program, but contends that the agency has no authority to use cost as a justification for lesser environmental controls. Congress addressed this point in the Fiscal 1982-83 Nuclear Regulatory Commission Authorization Act. The conference committee report which accompanied the legislation said:

The conferees are of the view that the economic and environmental costs associated with standards and requirements established by the agencies should bear a reasonable relationship to the benefits expected to be derived. This recognition is consistent with the accepted approach to establishing radiation protection standards, and reflects the view of the conferees that, in promulgating such general environmental standards and regulations, EPA and NRC should exercise their best independent technical judgment in making such a determination. At all times, the conferees fully intend that EPA and NRC recognize as their paramount responsibility protection of the public health and safety and the environment. (House Report No. 97-884, p. 47.)

DOE's authority under Title I of P.L. 95-604 extends only to implementing the general environmental standards set by EPA. DOE is under no authority to make the consideration of cost equal to or greater in importance than

20.7 protection of public health and the environment in choosing remedial action alternatives. To make such a determination, DOE would be overstepping its statutory authority and subverting EPA's standards to a second-class role. Additionally, EPA noted in adopting its final standards that strict cost-benefit analyses are not possible to carry out with any degree of certainty (EPA, 1983; page 596).

Common sense dictates that DOE can implement a less expensive technological "fix" if it accomplishes the same level of protection as another more expensive remedy. However, DOE cannot base a technical/engineering decision exclusively on cost without regard to level of protection -- as it appears to be doing in Sec. 3.1.4 of the DEIS.

1.3 Second, the matter arises of the importance of the geohydrologic study. DOE implies that the study will be used to determine if a "less-expensive" seepage control method will satisfy the EPA standards. Presumably, one type of "less-expensive" seepage-control method would be no seepage control. If the study shows that seepage control is not necessary, DOE may decide to adopt Alternative 2 as the proposed action. In this event, members of the public who supported any one of the three options for Alternative 3 must be given an opportunity to review and comment on the study. DOE may find it necessary to prepare a supplement to the DEIS on this issue. At the minimum, and regardless of DOE's decision on a preferred alternative, the department should make the study available before DOE commits to a particular remedial action at the Vitro site.

Sec. 3.3.2, page 47

2.4 Any consideration of active institutional controls, as suggested in the

214 third complete paragraph on this page, should be rejected. Such controls would not satisfy the EPA standards and would do nothing to remove a serious radiological and hazardous waste site from a fast growing area of a major population center.

Sec. 4.6.1, page 64

In the discussion of surface water flows at the South Clive site (third paragraph), DOE states, "Streamflows from higher elevations are normally evaporated and infiltrate into the ground before they reach lower, flatter land." The northeast-to-southwest gradient of the ground surface at the site suggests that this is true. However, the groundwater contour map of Figure A-25 shows a southwest-to-northeast hydraulic gradient, that is, despite the rise in surface elevation toward the northeast portion of the site there is a perceptible decline in the water table in the same area.

7.5 This decline in water table elevation toward the Cedar Mountains suggests that a subsurface physical control prevents recharge of surface water to the shallow site aquifer at the western periphery of the mountains, thus lowering the water table as it moves northeastward toward the mountains. Such a physical control may be a fault zone lying at the edge of the mountains at their interface with the valley fill -- a typical occurrence in basin and range physiological settings -- or, the subsurface dipping of the valley fill beds.

If seepage from the South Clive disposal site is permitted to go unchecked (that is, if clay lining of the proposed trenches is rejected), contaminated water may flow freely downgradient (northeastward) until a groundwater mound is formed at the periphery of the mountains. When this

7.5 occurs, the hydraulic gradient may change directions causing contaminated water to move south, west and north back toward the disposal site. The result may be a rise in elevation of the piezometric surface under the site in which the water table would be in direct contact with tailings and contaminated material. Hence, the emplacement of a clay liner under the South Clive site appears essential to preventing contamination of offsite groundwater.

Sec. 4.6.1, page 69

6.4 The first full paragraph (last line) of this page illustrates one of the many disadvantages of stabilization in place at the Vitro site. Probable maximum flood (PMF) flows in the Jordan River would inundate the stabilized Vitro site up to 11 feet above ground surface. Alternative 2 would result in a mound approximately 25 feet (Sec. 5.8, page 129) above the existing grade. Consequently, PMF flows at Vitro would cover about 40 percent of the reclaimed tailings, contributing to a degradation of the cover material, which provides only 6 feet of protection between the tailings and their external environment.

Flood flows at the South Clive site, on the other hand, are predicted to be sheet flows which could pass over the hardened, granular cover without causing appreciable damage. DOE could add to this level of protection by encasing the 6-foot above-grade cover at South Clive with a layer of riprap (boulder-size rocks encased in wire). This would not add substantially to the cost of the cover in that DOE already is considering an armoring layer of riprap on the northern and eastern toes of the impoundment where a surface runoff collection ditch is proposed (Sec. 3.2.4.5, page 40; Figure 3-8, page 41).

Sec. 4.6.2, pages 71-74

11.5 Vitro Site Water Quality. DOE admits that contamination of shallow groundwater under the Vitro site already has been occurred (page 72: "the shallow ground-water system has been contaminated by the past milling and tailings disposal activities at Vitro site"). Water quality data in Appendix D documents this contamination.

6.3 Groundwater samples taken in April 1982 from eight shallow-aquifer monitoring wells at the Vitro site show extensive radiological contamination (App. D, Table D-6): gross alpha averaged 207.9 pCi/l, based on a range of 3.7 to 1,181 pCi/l; radium-226 averaged 18.1 pCi/l, based on a range of 1.0 to 114 pCi/l; and total uranium (as U_3O_8) averaged 126.1 pCi/l, based on a range of 3.4 to 744.7 pCi/l. Total dissolved solids concentrations in these same wells in April 1982 samples averaged 4,197.4 mg/l with a range of 310 to 9,473 mg/l (App. D, Table D-5). Table D-4 of Appendix D shows that the screened interval of these wells ranges from 13 feet (Well V-DS) to 45 feet (Well V-HS). An inspection of Figure D-2 shows that this contamination is most serious beneath the southwest and south tailings areas. The most serious contamination at depth in the shallow system was in well V-HS which is screened between 35 and 45 feet.

The shallow system begins at depths of 2 to 5 feet below the surface (page 72). More than 120 wells serving the domestic water needs of South Salt Lake range from 100 to 400 feet below the surface within a half mile of the site (page 73); one municipal well of 850 feet in depth was said to yield 1,100 gallons per minute (gpm) (page 72). Figure D-2 shows the shallow water table trending west-northwest, a gradient which jeopardizes water quality in the industrial and undeveloped area west and north of the tailings. These data

6.3

demonstrate that groundwater use for human purposes is extensive in the area of the Vitro site and that the presence of the tailings constitutes a very real threat to groundwater in areas which may be developed following stabilization.

South Clive Water Quality. Water quality in four shallow DOE monitoring wells at the South Clive site averaged 35,600 mg/l TDS for four sampling occasions between September 1981 and August 1982 (App. D, Table D-11). Some radiological parameters also were elevated, apparently by natural conditions.

9.2

Despite the poor quality of groundwater below the South Clive site, steps should be taken to prevent a worsening of the situation. Given that the preliminary design of the disposal trenches is 20 feet in depth and that the depth to the water table ranges from 25 feet to 35 feet below the ground surface, the shallow aquifer would range from 5 feet to 15 feet below the bottom of the tailings. Figure A-26 shows that a 4-foot liner would reduce the initial seepage rate to 30 gpm and a 2-foot liner would reduce seepage from the tailings to about 50 gpm. These discharge rates would decrease substantially with time as the moisture content of the tailings decreases. While it is apparent that a clay liner will not prevent seepage, lining of the disposal trenches will nonetheless inhibit further contamination of the shallow aquifer and slow the rate of rise in the water table relative to the increase in water table elevation that may result from uncontrolled seepage. To verify this potential, DOE should present calculations showing the rate of seepage from unlined trenches in Alternative 3 and compare those rates to the projected seepage through the two clay lining options.

Secs. 4.7.1 and 4.7.2, pages 75-76

9.2

Information in these sections on the ability of native vegetation at the South Clive site to resist erosion seems contradictory. In the first paragraph of page 76, DOE states, "The highly saline, slowly permeable soils in this extremely arid location are unsuitable for re-establishing a lasting, self-sustaining vegetation to protect the soil covering the disposed materials." Yet in the last paragraph on the same page, the local vegetation is said to form "an important ground cover and deterrent to soil erosion. . ." DOE should clarify this point, although the available data suggests that a vegetative cover will be difficult to maintain and sustain at the South Clive site. This would be another reason for adding a layer of riprap to the proposed 6-foot cover.

Sec. 4.8, page 79

19.8

The order of the second sentence of the introductory paragraph to this section should be changed. The sentence should read: "Radiological dose rates and exposure are presented in millirem/year and microroentgens/hour, respectively."

Sec. 4.8.1, page 80

The subsurface radium-226 concentrations around and beneath the Vitro site demonstrate why groundwater there has been contaminated. These elevated concentrations (up to 560 pCi/g at the 1-foot depth, compared to a background concentration of 1 to 2 pCi/g) also have implications for decontamination of the site for unrestricted use, if Alternative 3 is adopted.

It is not clear if EPA's radium-226 standard for cleanup of "open lands"

applies to subsurface contamination beneath tailings piles (EPA, 1983; page 600). DOE did not address this issue in its discussion of the evacuation of the Vitro site under either Alternative 2 (Sec. A-4.4.2, page A-43) or Alternative 3 (Sec. A-5.4.1, page A-73). However, the subsurface radium concentrations discussed on page 80 show clearly that decontamination must proceed deeper than 1 foot below the tailings. The water quality analyses discussed above and in Secs. 4.6.2 and Appendix D of the DEIS also suggest that elevated radium concentrations are present at depths much greater than 1 foot.

11.5 To resolve this problem, DOE should undertake a soil sampling program to determine radionuclide concentrations beneath the Vitro site at depths greater than 1 foot. The discussion of site preparation for lining (Sec. A-4.4, page A-40) indicates that the Vitro site will be excavated to an average depth of 7 feet (last paragraph, page A-40). Thus, soil investigations as suggested above should be carried out to at least 8 feet below the tailings to determine if elevated radium-226 concentrations are present at this depth. The 15-pCi/g "subsurface, open lands" standard adopted by EPA can be used as a guide for decontamination, although DOE should be aware that this level is 7.5 to 15 times greater than background radium-226 concentrations.

11.5 Additionally, the EPA standard provides a regulatory guidance of averaging radium-226 concentrations over 100 square meters (Table 3-1, page 20). DOE should devise a statistical method (with significance at, say, the 95-percent confidence interval) whereby enough soil samples are taken to gain a representative radium-226 average over the entire 128 acres of the Vitro site.

Sec. 5.1.3, page 106

12.3 Radiological Comments. DOE should discuss in greater detail why it selected the radon and external gamma radiation (EGR) risk factors presented on page 106. The two-sentence explanation at the bottom of the page says only that there is a wide difference in expert opinion on the matter of risk of cancer from exposure to ionizing radiation. These differences should be spelled out clearly. Appendix F shed no additional light on this matter; it only gave the technical methods for determining doses from various radiological source terms and how the MILDOS and AIRREL codes were used to relate the various dose-delivering parameters. The discussion on page 106 and in Appendix F also fails to mention the quality factor (Q) DOE has chosen to assign to alpha radiation, the principle radiation emitted by uranium-decay series radionuclides, particularly radon and its progeny.

11.3 As mentioned in the General Comments section above, one of the main weaknesses of the DEIS was its failure to give much credence to nonmalignant diseases caused by exposure to ionizing radiation and reliance on deaths from lung cancer (through exposure to radon and its progeny) in its estimation of the health effects caused by the three alternatives, including No Action. Appendix F provided valuable background data and important insights into the methods by which the dose commitments of Tables 5.1 and 5.2 (pages 108-109) were derived, but gave little information on how the expected number of excess deaths were derived. An inspection of Sec. 5.1.4 (page 107) shows that the number of excess deaths was obtained simply by multiplying the dose commitments of Tables 5.1 and 5.2 by the risk factors for radon and gamma exposure on page 106. No reference or other basis was given for using this formula.

12.3 In addition to these deficiencies, and as noted in the General Comments section, dose commitment projections were computed only for healthy, adult members of the population. Table F-21 in Appendix F (pages F-55 to F-56) attests to this problem. The time-weighted exposure data was valuable in that it showed decreasing doses over time following completion of remedial action (Table F-21), but no attempt was made to consider doses to the more sensitive members of the population: developing fetuses, children and elderly individuals. DOE must clarify why it chose not to consider these matters in its estimation of health effects. Until it does, we conclude that the number of health effects predicted in Table 5.1 may be underestimated, especially those resulting from chronic exposure to the No Action Alternative.

11.3 Worker Exposures. Appendix F predicted very large doses to remedial workers. External gamma exposure alone was calculated to be 3 rem/yr (whole body) for each of the three years of remedial action. Lung doses from radon inhalation was estimated to be 3.2 rem/yr for each of the three years. Thus, cumulative worker exposure from radon and EGR sources may approach the ICRP and worker limit of 5 rem/yr, whole body (CESC, 1978; page 49). The DEIS does not address the cumulative effects of exposure to both radon and EGR other than to multiply the dose commitments of Table 5.2 (page 109) with the risk factors of page 106.

17.4 Neither is there much discussion about exposure mitigation measures. Worker exposures during remedial action can be lessened by the wearing of respirators, frequent relocation to work areas not containing radioactive materials and other shielding measures. DOE should list what mitigation measures it plans to require for contractors employing remedial workers.

Sec. 5.3.2, page 115

7.7 Another advantage of Alternative 3 is that the necessary cover materials can be obtained from the local environs without large land disturbance. Material excavated from the trenches contains a high amount of clay and greater moisture content. Gravel for the granular outer cover layer and boulder-size rocks for possible riprap features can be obtained from the nearby mountains. The availability of clay materials at the site also facilitates installation of a clay liner.

Sec. 5.3.4, page 116

19.8 In the second full paragraph, a reference is made to "Choar, 1959." The reference table on page 141 lists "Chow, 1959," but nothing by "Choar". This should be corrected.

Sec. 5.4.2, page 120

6.2 The upward movement of groundwater may result not only from the hydraulic head of the deep aquifer, but also from capillary forces in the vadose zone above the shallow aquifer and in the unsaturated area above the deep aquifer (if, indeed, that area is unsaturated). Regardless of the cause, the potential for reversal of the vertical gradient appears very possible, especially if local groundwater use increases as the DEIS suggests it might. Stabilization in place might accelerate this process through discharge of seepage from the tailings, especially if a liner is not used. The fact that groundwater conditions are unsuitable for permanent tailings disposal (for example, high water table, pervasive contamination, etc.) at the Vitro site suggests that the tailings and contaminated material should be relocated and the entire 128-

acre site decontaminated.

Sec. 5.4.3., page 120

9.4 This section discusses whether different types and thicknesses of liners, or no lining, will meet the EPA standards for groundwater protection (which, under the final standards, essentially are existing state and federal water quality criteria). Figures A-11, A-12, A-13 (pages A-28 through A-31)

demonstrate the seepage attenuation properties of a clay liner for radium-226.

However, if another regulated contaminant would have been used to predict seepage migration, the spread of that contaminant, in terms of its concentrations, certainly would be more widespread beneath the unlined tailings than Figure A-11 shows. Radium-226 is a notoriously slow mover. DOE should construct seepage migration models and graphics to compare the rate of migration of other more mobile contaminants under the various seepage-control (liner) options.

Sec. 5.6, page 125

10.2 The No Action Alternative and Alternative 2 would prohibit or inhibit, respectively, expansion of the CVWRF. Alternative 3, however, would permit the Board's expansion plans to proceed. The "permanent preemption" of the 200 acres at South Clive is a much less serious impact on land use than either Alternative 1 or Alternative 2.

Sec. 5.9, pages 130-131

10.8 DOE should discuss how it determined the number of individuals who would "immigrate" to Salt Lake City to take remedial action jobs. The number of jobs

10.8 that would be created by either Alternative 2 or Alternative 3 is small; it would seem more likely that these new, but limited employment opportunities would be taken by persons from the local communities seeking work. DOE should explain how its construction contractors will hire workers and under what conditions, if any, preference will be given to local workers.

Sec. 5.11, pages 134-135

10.5 It is clear from the data on these pages that Alternative 3 will create more new jobs and greater benefits to the local economies than Alternative 2. These benefits will be small in comparison to existing employment and economic structures. However, they nonetheless will constitute a "return" on South Salt Lake's unfortunate "investment" of having to live with hazardous uranium mill tailings for so many years.

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Dr. Vollney Wallace
April 1983

The original letter has been misplaced and is reproduced in part.

I consider the chance of an epidemic of lung cancer compelling reason for doing as I have just suggested and see no compelling reasons to the contrary. My views of the contrary reasons follows.

The proposed action terminates the pollution of underground water. The pollution wasn't particularly serious anyway. The shallow wells affected are or at least ought to be contrary to public policy for they are sensitive to contamination from filthy surface waters, leaking sewers, leakage from the Vitro site sewer plant, extract of road tar and so on. If, rather when for the water is already polluted, the pollution reaches these wells, the arsenic can be taken out with ion exchange resin.

6.2 The specter of Vitro leachate contaminating the deep artesian water due to heavy usage of this water is unrealistic. That heavy usage of the water will render it polluted by sewage, filthy runoff water, road tar extracts and so on, so the condition will be avoided.

As I pointed out in the Tooele hearing, a planting of desert shrubs on the stabilized pile will terminate penetration of meteoric water into the tailings.

9.5 The complaint of having to tend the pile for millenia is also unrealistic. Due to our inexorable depletion of our resources, in several decades that pile will be a valuable mineral resource and will be mined for its mineral value. The reprocessing will be done by safe procedure, probably hydraulic and robotic equipment will be used in the actual handling of the tailings, and the tailings will be disposed of in a proper permanent way at no cost to the taxpayer. The reprocessing of the tailings at that time will be a boost to both the local and general economy.

20.1 I personally am opposed to taking a gamble if I cannot afford the consequences of losing or if I commit innocent other people to take consequences of my losing the gamble. I despise people who take such gambles, such as the person who will pass on a blind curve or the loser who tries to whine his way out of his predicament. That principle and my perception of the hazard of radioactive dust leads me to the opinion that the Vitro tailings should be stabilized in place with an absolute minimum of moving of the tailings. I would go along with the proposed cover of clay and gravel but would propose as I did at the Tooele hearing that the pile be planted with a desert plant. I tentatively propose that the present load of water in the tailings with its dissolved arsenic be removed by pumping.

13.4 The complaint of taking away of needed land from the sewer plant there is also unrealistic. Progress in sewage technology has and will continue to take the pressure of land off from sewer plants. The Japanese have already devel-

-2-

oped a small land area oxygenator. It is possible that land can be gained by reducing the inventory of sludge and it is possible that the tailings pile can be used for storage of dewatered sludge. I pointed these things out at the Tooele meeting.

ABSTRACT

Radon daughters appear to have been overestimated and radioactive dust underestimated as causes of lung cancer. The advisability of disturbing the Vitro tailings, other than to cap them, is highly questionable.

EPA ESTIMATES OF CANCER CAUSED BY VITRO TAILINGS

The environmental impact statement on the Vitro tailings is characterized by exact, dogmatic statement on the amount of cancer that will be produced by the tailings under specified conditions. No confidence limits nor explanation is given nor is a distinction between the hazard of dust and gas made.

The EIS does mention that it is lung cancer that will be produced and that the daughters of radon are in particular the cause. This indicates that the EPA used mortality data for uranium miners, who suffer from a quite high incidence of lung cancer. The estimates given are not possible except one assumes a zero threshold of radiation effect, indicating that this assumption was also made.

RADIOACTIVE DUST VERSUS RADIOACTIVE GAS AS A CAUSE OF LUNG CANCER

12.4 Particles of dust larger than about 0.01 mm tend to lodge in the upper respiratory tract and are removed from the body by coughing, sneezing and blowing of the nose. Particles 0.001 to 0.01 mm in size tend to lodge in the lungs. Smaller particles tend to remain airborne and if inhaled are immediately exhaled. The particles that deposit in the lung are normally swept back up the respiratory tract by the cilia of the lungs. This action is not perfect, though, as indicated by the occurrence of silicosis and black lung among hard rock and coal miners respectively, and the problem of asbestos in the environment. If I recall news releases of a few decades ago correctly, the action of cilia in the lungs is weak or absent in smokers. It follows that if there is radioactive dust of a particular size in the air, there will be deposited in some peoples lungs, permanently, a number of radioactive particles.

Given a radioactive particle lodged in the lung, with an average radiation of one alpha particle per day. In the course of a year it will irradiate a dozen or so lung cells with a total of 365 alpha particles. This is more than enough to cause cancer, indicating danger from particles with as little radiation as one alpha particle per week or month.

-3-

In the 1950's a retroactive study was made of causes of death among uranium miners and uranium mill workers. The miners, who are heavily exposed to radioactive dust, had a very high incidence of lung cancer and, not surprisingly, it was by far the highest among those that smoked. The uranium mill workers, in spite of their exposure to high levels of radon and radon daughters, had a normal incidence of lung cancer. This indicates that it was radioactive dust particles causing the lung cancer, not gaseous radon or its radioactive daughters. Surprisingly (not surprisingly if you are aware of the fallibility of science) this conclusion has been overlooked or ignored and in its place the theory that radioactive daughters of radon are responsible has been substituted. The reason for it I do not know. I suspect dominance of the radiation health scare and the mistaken understanding that radon decomposes to radioactive particulates. The latter may have arisen from handbook listing of the radioactive daughters as solids, coupled with lack of understanding of extreme low vapor pressures and metastable gases. It may have arisen instead with failure to appreciate the fact that reactive gases can be picked up by a filter by process of chemisorption.

12.4 I have no direct data on whether gaseous radioactive daughters of radon can deposit and stay in the lung long enough to cause lung cancer, other than the absence of excess lung cancer in uranium mill workers. From my professional understanding of molecular processes I find it unlikely. This involves the dynamics of gaseous diffusion and short duration sorption processes which I will not go into. Rather I shall use a close, familiar analogy.

He who takes an incautious whiff of concentrated hydrochloric acid, concentrated ammonia or glacial acetic acid is in for a rude surprise, an explosion of pain in the nose and sinuses. Gaseous diffusion processes are sufficiently fast that the upper respiratory tract filters out these vapors. The mucus and the mucous membrane dissolve these gases essentially irreversibly and stops them from getting into the lower respiratory region. If the gas or vapor is volatile and poorly soluble in water, it is absorbed just the same by the upper respiratory tract (molecules not soluble in water do not avoid impacting on mucus) but creates a thin layer of lower concentration, high saturation solution in the surface of the mucus from which the vapor or gas evaporates and continues its trip down the respiratory tract. The gaseous radioactive daughters of radon should be captured thus by the upper respiratory tract and, lacking particular volatility, should go no further. Not reaching the lungs, they cannot produce cancer of the lungs.

Let us suppose that we erred, that the radioactive daughters of radon do actually reach the lung and are taken from air suspension by the lungs. They are solitary atoms by their species and so are in solution when picked up by the lungs. They would be expected to be carried off immediately by the bloodstream, not staying in the lung long enough to expose the lung to much radioactivity. Either way, it looks like radioactive particulates far exceed radioactive gas in ability to irradiate the lung with cancer causing radiation.

-4-

There is more to it than this. Some radioactive minerals are more radioactive than others, some are more radioactive because of greater particle size, some of the minerals dissolve quickly in body fluids and do not reside a long time in the lungs, other factors are involved in carcinogenesis as well, and so on. I rather suspect but it's only a guess, that the culprit is a quartz particle with an inclusion of radioactive mineral.

VITRO DUST

12.4 One of the speakers at the Tooele hearing on the Vitro EIS complained that the tailings were 40% sub-200 sieve. Maximum particle size in that 40% fraction is about 70 microns. There should be a considerable amount of 1-10 micron size particles in that fraction, easily airborne materials (the mentioned speaker complained that the operations would be extremely dusty). I think it follows that under either option II or option III of the EIS that a lot of Salt Lakers would get a lung full of radioactive dust and that an epidemic of cancer of the lung would follow.

I cannot say absolutely that the lung cancer of the uranium miners _____ by radioactive dust and that the Vitro tailings pile dust will have the same effect. I believe, though, that I have a better case for it than the present case for lung cancer from radon escaping the Vitro tailings pile. The decision of what to do with the Vitro tailings will have to be made under the cloud of uncertainty on this point.



Tooele County

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Home of the World Famous Bonneville Salt Flats

47 South Main Street, Tooele, Utah 84074

March 14, 1983

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Mr. James A. Morley
Project Manager
Uranium Mill Tailings Project Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

The Tooele County Board of County Commissioners appreciate the opportunity to voice our objections to the movement of the Vitro Tailings now located in South Salt Lake City to the location at Clive, Utah located in Tooele County.

Certainly Tooele County can sympathize with Salt Lake City, but Tooele County did not create the tailings pile neither did we receive tax money or the benefits of employment for some of our County citizens. It is the intention of the County Government and the concerned citizens to take every step available to us to prevent our County from becoming a nuclear dumping grounds.

Tooele County presently stores the free worlds supply of nerve gas at Tooele Army Depots South Area, including the much discussed wet-eye bombs. Many experiments using nerve gas and germ warfare materials have been conducted at Dugway Proving Grounds, Tooele County.

We are world reknown for killing a large nmbor of sheep near Dugway Proving Grounds, and for sometime following the incident people from out of State and even some people in State were apprehensive about traveling Highway I-80 West between Salt Lake City and Wendover.

15.1 It is the Commissioners concern that to dump the Vitro Tailings in Tooele County would place a stigma on the County that would discourage industry, and especially those employees who follow the industry, from building and living in Tooele County.

Letter to Mr. James A. Morley
March 14, 1983
Page Two

15.1 Another concern is that once we allow the Vitro Tailings to be placed in Tooele County we will eventually become a dumping grounds for other low grade nuclear waste material.

We understand that under the present law this could not happen, however, laws and Government officials can be and are often changed.

11.2 The fact that there is no medical evidence and the State Board of Health can produce no records that the Vitro Tailings in their present location is a health hazard to people living in the close vicinity of the trailings pile.
20.1 It is, therefore, the recommendation of the Tooele County Commissioners that the Vitro Tailings pile be stabilized in place at a greatly reduced cost to both State and Federal Governments.

20.9

Sincerely,

BOARD OF COUNTY COMMISSIONERS

Charles Stromberg
CHARLES STROMBERG, Chairman

Reed Russell
REED RUSSELL

Lee V. Bracken
LEE V. BRACKEN

RR/pl



610 South 2nd East, Salt Lake City, Utah 84111
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HARRY L. GIBBONS, M.D., M.P.H.
Director

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March 31, 1983

Mr. James A. Morley, Project Manager
Uranium Mill Tailings Project Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

Enclosed are the comments of the Salt Lake City-County Health Department on the Vitro tailings draft environmental impact statement. We would appreciate your full consideration of our remarks in the preparation of the final environmental impact statement.

Sincerely,


Harry L. Gibbons, M.D., M.P.H.

HLG:jt

Enc.

RECEIVED
DOCUMENT CONTROL

13 APR 1983

20.1

Our office has carefully reviewed the latest available Draft Environmental Impact Statement on Vitro. This document sets forth three possible alternatives for the Vitro site: no action (alternative 1), stabilization in place (Alternative 2) or removal of the tailings and accompanying contaminated material to the South Clive site (Alternative 3). Alternative 1 is not an acceptable or viable option, and will not be discussed. For a number of reasons we believe that Alternative 2, the plan to stabilize the tailings in place is "fatally flawed," and we are therefore opposed to this concept. We have no objection to the proposal to relocate the tailings, and believe that this is the course of action which should be followed. Regarding the stabilization in place alternative, our concerns are related not only to specific technical points discussed in the Draft Environmental Impact Statement (DEIS), but also to certain decisions and judgements which have been made in preparing the DEIS itself. These points will be discussed in this paper. There is no particular significance to the order in which they appear.

2.4

To begin, we are concerned by a number of statements given in the foreword of the Draft. These statements are disturbingly clear in explaining that the final parameters for the stabilization in place alternative not only may but likely will differ substantially from elements of this action described in the DEIS. Further, we believe that these and other statements which will be quoted shortly open the door for a lowering of the final standards to which the stabilization in place alternative would have to conform.

In the foreword an explanation is given that the final EPA Standards for Remedial Actions at Inactive Uranium Processing Sites were published just prior to the DEIS being sent to press. Quoting from the foreword:

"Because the final EPA Standards are somewhat less stringent than the (previously) proposed standards, all of the action alternatives described in this DEIS will satisfy the requirements of the final standards. Also, the designs finally adopted can be expected to result in somewhat lower construction impacts than are addressed in the DEIS. Expected changes include reduced cover thickness, reduced volumes of materials to be removed from open lands, and reduced transportation impacts for cover and fill material."

This paragraph is disturbing for a number of reasons. The final EPA Remedial Actions at Inactive Uranium Processing Sites Standard did remove reference to a specific table of contaminant concentrations, but by no means gave blanket endorsement to the type of plans proposed in the DEIS. In fact, the final standard may have provided a vehicle which will result in a more rigorous solution than if specific contaminant levels were given. To quote from Section 192.20 "Guidance for Implementation" of the final EPA Remedial Actions at Inactive Uranium Processing Sites Standard (40 CFR, Chapter I, Subchapter F, Part 192 issued December 15, 1982):

-2-

"Judgements on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's Hazardous Waste Management System (47 FR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

2.4 In other words, EPA's Hazardous Waste Management System and State regulations may be used to specify ground-water requirements, which could be even more restrictive than the initial ones the EPA proposed in their original Remedial Actions at Uranium Processing Sites standard.

Regardless of what standards the State might specify, a comment on page 19 of the Draft opens the door to the possibility that the DOE may be able to back away from the guidelines in the final EPA Remedial Actions at Inactive Uranium Processing Sites Standard itself.

"As indicated in table 3-2, under exceptional circumstances when the EPA standards cannot be fully met, the DOE may select and perform remedial actions that come as close to meeting the EPA standards to which the exception applies as is reasonable."

It must be remembered that the stabilization in place alternative described in the DEIS is not in its final form. The foreword makes a rather nebulous statement regarding "lower construction impacts than are addressed in the DEIS". Literal interpretation of the preceding quote gives D.O.E., with N.R.C. concurrence, considerable latitude (for D.O.E. convenience) to declare that exceptional circumstances exist and vary the final design as they wish, as the stabilization in place alternative plan is not in its final form.

Even if the scope of the stabilization in place design is not changed from that proposed in the DEIS, the full design for stabilization in place as presented in the DEIS is not adequate. For example, considerable study is set forth in the DEIS related to the alternatives between a slurry wall and a clay liner for the encapsulation cell at the Vitro site. The DEIS makes clear that a commitment to the clay liner concept has not been made and that a liner may well be omitted. To quote from page 22:

"The clay liner may not be needed under the final EPA standards provided that it can be shown that other, less-expensive means of seepage control would meet the ground-water protection requirements of the final standards. The clay liner is nevertheless incorporated in the design for alternative 2 (stabilization in place) to provide a worse case design on which the analysis of construction impacts can be based."

Quoting further from page 23:

"If engineered protection is not needed (of the deep ground-water system)--that is, if the no control option will meet EPA standards--then the liner option will not be the preferred option in the final design for the stabilization in place remedial action."

-3-

It is logical to assume that if the clay liner is omitted, a slurry wall will then be used to confine contaminants. The slurry wall concept has a particularly striking weakness, however, as the DEIS itself admits. To quote from page A-32:

6.2 "The effectiveness of the slurry wall concept is related to the maintenance of the upward hydraulic gradient beneath the stabilization area. If extensive ground-water development and increased pumping were to occur within the area of the Vitro site, the upward hydraulic gradient could be reduced or reversed. This would result in a loss of hydraulic containment and an increase in the potential for downward migration of contaminants from the tailings."

An additional paragraph on this page indicates:

9.4 "Because of the hydrogeologic and soil conditions at the Vitro site, the integrity of the slurry wall can be expected to last longer than that of the liner. Although the slurry wall alternative would present a greater contamination potential in case of failure after installation, the failure of the slurry wall would be easier to detect and the remedial measures would be less costly."

6.2 This statement alone recognizes that stabilization in place is not a long term solution. Several places in the Draft speak of stabilization for a period of a thousand years. Yet these two paragraphs admit to the possible failure of the clay liner, possible failure of the slurry wall and dependence upon the upward hydraulic gradient to assist in the containment of contaminants. In future years there will be substantially increased groundwater withdrawal in the vicinity of the Vitro site, as well as all across the Salt Lake Valley. In addition we cannot be sure that the aquifers will continue to be recharged at the rate they have been. There is no guarantee that the currently favorable upward hydraulic gradient will indefinitely continue.

14.2 An additional fact which makes the stabilization in place alternative so undesirable is that the potential hazard from the tailings will virtually never disappear. The half lives of the radioactive components of the tailings is many thousands of years, but there is even a longer lasting health hazard. Looking beyond the radionuclides, the heavy metals present in the tailings will never "burn out". The leachability of the tailings has not been well examined, having taken a backseat to the radiation concerns, yet this may well be the most significant long term hazard of the tailings. The tailings have substantial concentrations of many potentially hazardous elements and compounds such as arsenic, selenium, chromium, lead and antimony to mention only a few of the dozens present. As a graphic example of this hazard, data collected between 1967 and 1971 showed that waters discharged from the Vitro tailings had hexavalent chromium levels as high as 58 ppm (that is 1160 times higher than the National Interim Primary Drinking Water Standards). This high value alone would be sufficient to classify this discharge as a hazardous waste stream.

Regarding hazardous waste sites, at the present time there are a number of problem areas within Salt Lake County being investigated by our office and by State and Federal agencies because of toxic contaminants. But none of them have as wide a diversity of or as high a total concentration of contaminants as is found within the Vitro tailings. Several of these sites may require substantial corrective action. To leave such a huge concentration of heavy metals and other contaminants permanently in any population center is not logical.

- 9.4 [There is no guarantee that a clay liner of the type proposed in the DEIS has the capability of maintaining its integrity for a thousand plus years. Although there are theoretical arguments, there is no track record for such a system. Recent studies have indicated that clay liners are more permeable and subject to failure than previously thought.

Page 45 of the DEIS makes a statement, related to groundwater contamination which is alarming.

"Alternatives 2 and 3 would not differ in their radiological and non-radiological impacts on ground- and surface-water quality. Either alternative would meet the EPA water standards. In any case, the ground- and surface-water systems involved do not contain potable water."

- 6.3 [This statement is simply not true. Within one-half mile of the tailings there are currently 41 wells less than 120 feet in depth. Some of these are much more shallow than 120 feet and at least half of these are downstream from the pile in relation to the movement of the underground aquifers. Additionally, there are many other wells in the same area which are deeper than 120 feet. According to the DEIS itself, one local municipality, South Salt Lake, is considering using a portion of the deep water system under the Vitro site as part of its water supply. We live in a region of the country where water is very precious. Our valley has been inhabited for only 136 years. The tailings lie in the groundwater system in the heart of one of the fastest growing metropolitan areas within the United States. To leave the tailings potentially in contact with this groundwater system is totally unacceptable.

- 6.1 [In several places the DEIS refers to the forthcoming groundwater study which is to address and resolve some of the issues related to groundwater just discussed. The timing of this study borders on the ridiculous. The study is to answer vital questions such as what would happen to the stabilized tailings if the upward hydraulic gradient were to be reversed. Our understanding is that this groundwater study started in mid-March of this year and that it will be completed within 6 to 10 weeks. In reviewing this proposed study we have spoken with a number of hydrology experts. The unwavering consensus is that while the data to be gathered will be interesting, it is far too brief a study to provide the necessary data needed on seasonal or cyclic changes within the underground aquifers. Also the current short term study is being conducted during a time when the soil is more saturated than it has been for many years. In light of this we must wonder if the hydrology study is nothing more than a "band-aid" attempt to pacify the local citizenry while continuing upon a pre-set course.

Considering the alternatives for remedial action it is vital to remember the philosophy that Congress followed in passing the legislation for tailings remedial action. The Congressional Report accompanying P.L. 95-604 expressed the view that the methods used for remedial action could not be effective for only a short period of time. Quoting from the report:

- 16.1 ["The committee believes that the uranium mill tailings should be treated...in accordance with the substantial hazard they will present until long after existing institutions can be expected to last in their present forms," and, "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time." (H.R. Rep. No. 1480, 95th Cong., 2nd Sess., Pt. I, p. 17, and Pt. II, p. 40 [1978]).

Even under the most favorable conditions of hydraulic gradient and liner integrity, continued active surveillance and monitoring of the pile will have to continue indefinitely if it is left in the heart of the Salt Lake Valley. If the pile does develop leakage problems years from now, what problems will this pose our descendants, and who would pay for the remedial work?

There is an additional reason we are concerned with the stabilization in place concept as presented in the DEIS. A great deal of time and effort went into studying alternative disposal sites, to insure that one having the proper configuration of groundwater, long term stability, and other favorable parameters was selected. It therefore appears to us that DOE is following a double standard in proposing long term stabilization in place at the Vitro site. The South Clive site was very carefully selected, as an alternate disposal site, after reviewing many areas. Would the Vitro site be considered for long term stabilization, if the tailings did not now reside at that location? Of course not, since the Vitro site fails to meet the rigid selection criteria as an alternative disposal site. We currently do not have a hazardous materials landfill within the county, nor are there plans or a desire to develop one. If we were seeking to develop a hazardous landfill site we certainly would not place it in the middle of a populated area. We would not place it in an area of high groundwater. Were the Vitro tailings not now there, it is doubtful that we could put comparably contaminated hazardous waste at that site no matter how badly we wanted to. Yet DOE is telling us in their DEIS that the Vitro site is a fine and acceptable location for long term stabilization. To leave the tailings there, as a final secure resting place flies in the face of the Congressional intent behind the Act, as well as railing against common sense.

- 20.7 [We have been told repeatedly that DOE has not made a final selection, but that is is considering Alternatives 2 and 3 in an open minded fashion, not on the basis of economics alone. Yet DOE's direction is to perform remedial action, consistent with EPA standards, in the most cost effective manner. Their entire budget for remedial actions nationwide, at all tailings sites (not just Vitro) in 1983 is approximately 20 million dollars and in 1984, if their full appropriation request is granted, 27 million dollars. Considering the projected 61 million dollar cost of moving the tailings to the South Clive

20.7 site, after deducting the State's 10% share. DOE would be left with an annual 3 year average price tag of approximately 18.3 million dollars for Vitro alone. Their budget has obviously not been built to accommodate this. In light of this fact, we have to assume that DOE is under a great deal of pressure to propose and accept the stabilization in place alternative short of a "fatal flaw" which may be detected in the stabilization in place proposal.

9.5 By way of summary and conclusion, it is our belief that the proposed plan to leave the tailings in place is conclusively and ultimately "fatally flawed" for a number of reasons. The tailings pile is located within the groundwater system in the heart of one of the fastest growing metropolitan areas of the United States. Our valley has been inhabited for only 136 years, and will undoubtedly experience great growth and change in the coming years. In order for the stabilization in place concept to work successfully, stable hydrogeologic conditions must exist in the valley, including the present upward mobility of the under-ground aquifer, for a period of time exceeding up to 50 generations. Fifty generations--that's an awfully long time.

9.5 9. Additionally there is no guarantee that the clay liner or slurry wall (or less) containment systems proposed will last that long. Although there are theoretical arguments, there is no proven track record for such systems. As previously indicated, recent studies have proven that clay liners are more permeable and subject to failure than previously thought. And all the while the potential radiation hazard and the hazard of heavy metal poisoning of our water system will continue. If and when leakage, or other problems do develop in the future, as they well may, what costs and social problems will be incurred by remedial actions at this future time? And who will pay? Would the Vitro site be chosen as a final disposal site if it were not already there? Certainly not. We vigorously object to the federal fixation on cost which has forced DOE not only to propose but attempt to sell us an inadequate and short-sighted solution.

The uranium extracted at the old Vitro Site was done for the sake of national defense, for the good of all the citizens in the United States. It is a federally fouled nest in the heart of our city which both should and must not be a continuing burden to the residents of Salt Lake County. The only permanent, adequate, sure and acceptable solution to the problem lies in removal of the tailings. To do anything less is to leave our decedents a potentially terrible legacy.



ER 83/241

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

APR 5 1983
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James A. Morley, Project Manager
Uranium Mill Tailings Project Office
Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

We have reviewed the draft environmental impact statement for Remedial Actions at the Former Vitro Chemical Company Site at South Salt Lake, Salt Lake County, Utah. The analysis indicates (p. C-13) that while reprocessing the tailings could recover 508,239 lbs of U_3O_8 , 2,160,070 lbs of V_2O_5 , and 283,753 lbs of Mo, having an estimated gross value in excess of \$20 million, this would not be economical. We believe that the option of reprocessing this material should receive further examination before the opportunity to recover these mineral resources is foregone.

5.4 The preliminary studies were based on reprocessing of the tailings at a new process plant, using a heap-leaching process and we agree that this would not be economically feasible at today's prices. A similar alternative, however, involving reprocessing and disposal of the tailings at an existing uranium recovery plant (mill), apparently has not been considered. Although the cost to transport the tailings would be high, recovery of salable products at an existing plant, disposal of the tailings at a licensed facility, and the lack of costs for tailings disposal at the South Clive or Vitro sites might make this a feasible alternative.

5.3 Still another alternative that should be considered is burying the Vitro tailings below mine waste dumps generated by Kennecott Copper Corporation at their existing Bingham Canyon operation. These dumps already contain low concentrations of uranium which Kennecott has attempted to recover during ongoing, standard copper recovery operations. Economic and environmental advantages offered include:

- (1) The Bingham Canyon leach dump area is close to the existing Vitro site, yet removed from population centers of the Salt Lake valley.
- (2) The Vitro tailings could be effectively covered by large volumes of waste rock generated by existing operations at the Bingham Canyon mine.
- (3) Potential recovery of residual uranium values could be incorporated into the existing copper cementation circuitry. Capital cost expenditures associated with recovering uranium and vanadium at a new plant site would be saved.

James A. Morley, Project Manager

2

- 5.3
- (4) An existing waste site would be utilized, which probably would be at least as favorable environmentally as previous considerations (sec. 3.2.5.3) to dispose of the tailings by utilizing them in public construction projects, such as highway exchanges or airport runway extensions.
 - (5) Public goodwill would be gained by a private company in aiding the community to solve a long-standing problem.

Obviously, processing the tailings through either an existing uranium mill or a copper facility such as Kennecott's would require negotiations with and acceptance by the private operator. We do believe these alternatives are worth further examination before a final decision on remedial action is made. Moreover, we believe that these types of alternatives also should be considered during the course of studies for remedial action on uranium mill tailings at other sites designated under P.L. 95-604.

Specific comments are enclosed.

Sincerely,

Bruce Blanchard
Bruce Blanchard, Director
Environmental Project Review

Enclosure

SPECIFIC COMMENTS

- 16.1 Page 8, Part 1.2.2 - This paragraph states that the Nuclear Regulatory Commission (NRC) will issue a license for the long-term maintenance and monitoring at the Vitro site (Alternative 2). Perhaps it would be appropriate that the statement include a specific commitment to develop a program to monitor the ground water, all seeps from the confinement area, and surface waters. This is very important and should not be left up to the NRC license process. The statement should also include commitments to provide security for the site as well as a program for proper maintenance of the confinement area.
- 6.3 Page 73, Part 4.6.2 - The statement indicates all the test wells at the Vitro site contain pollutants that violated the Environmental Protection Agency's safe drinking water standards. The statement also indicates that there are 121 domestic wells within 0.5 miles from the Vitro site. The statement did not indicate if the tailings contaminated any of these wells. If there is a pollution problem with any of these wells, removal would seem to be the wisest choice to make on the final disposal of the Vitro tailings. These wells should be tested and monitored for pollutants from the tailings.
- 6.2 Page 103, Part 5.1.1, 4th Paragraph - This paragraph states "...there is no evidence that the potable water drawn from deeper ground-water system under the Vitro site has been contaminated by tailings-derived materials." On page 72 (Part 4.6.2, 4th full paragraph), however, it states that some deep test wells contain gross alpha, radium - 226, and radium - 228. If these pollutants did not come from the tailings, what was the source?
- Page 118, last paragraph - The long-term benefits of Alternative 2, stabilization-in-place, are mentioned but not those of Alternative 3, removal to South Clive. Apparently the stated benefits are only in relation to the No-Action Alternative. The long-term benefits of removal at the Vitro site would be greater than those of Alternative 2 since the potential of eroding the tailings in extreme floods would be eliminated.
- 6.2 The suggestion that a liner may not be worthwhile at the South Clive site seems to be borne out by the very poor quality of the underlying ground water (tables D-11, D-12). However, we believe that the concept that stabilization at the Vitro site might also be accomplished without a liner needs more extensive analysis. One of the deep Vitro wells is being considered for use as part of a public water-supply system (p. 73) and long-term withdrawals may locally reverse the present upward hydraulic gradient. The statement should analyze the potential for migration of pollutants already noted in the shallow ground water and of those which may continue to seep from the onsite tailings pile—both with and without a liner (tables D-5, D-6; p. 12). Physical-chemical properties of the soils that would underlie the Vitro site tailings and of any liner materials that might be considered should be included in the statement.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

1860 LINCOLN STREET

DENVER, COLORADO 80295-0699

APR 6 1983

Ref: 8AW-RC

Mr. James A. Morley, Project Manager
 Uranium Mill Tailings Remedial Action Project
 U.S. Department of Energy
 5301 Central Avenue, N.E., Suite 1700
 Albuquerque, New Mexico 87108

Dear Mr. Morley:

In fulfillment of our responsibilities under Section 309 of the Clean Air Act I am enclosing the comments by the Region VIII Office of the Environmental Protection Agency on the Draft Environmental Impact Statement (DEIS) for Remedial Actions at the Former Vitro Chemical Company Site, South Salt Lake, Salt Lake County, Utah (DOE/EIS-0099D).

According to the standard rating system we would rate this DEIS as ER-3, meaning that we have reservations concerning some aspects of the proposed study due to inadequate assessment of economic and certain environmental impacts. Specific comments or corrections are attached. In general, however, there are several significant points which may be cause for concern and which should be developed more completely in the final statement. These are the impacts on the Central Valley Water Reclamation Facility, the potential impacts of the action on groundwater at the Vitro site, and the often ambiguous or equivocal details of the various alternatives. Recalling that this site provided much of the impetus for passage of the Uranium Mill Tailings Radiation Control Act of 1978, it is surprising how many areas of the studies are still incomplete.

- 10.2 13.1 As you know, EPA Region VIII has had an involvement with the water quality needs of Salt Lake County which has paralleled the various radiological investigations at the Vitro site back to 1970, and even before. The plans leading to the decision to construct a regional wastewater treatment facility were not drawn in haste and involved the study and concurrence of a large number of municipalities and state agencies. Population growth along the Wasatch Front has strained the municipal facilities and led to serious water pollution problems. Further delays and uncertainties in the expansion of the Central Valley facility will only serve to exacerbate the problem. The stabilization-in-place alternative, as conceptually presented, may hamper current plant expansion to a capacity of 50 million gallons per day (mgd), and make it difficult to expand to 100 mgd without further land acquisition which is itself of questionable feasibility. The cost of the plant expansion as presently conceived is estimated between 80 million and 100 million dollars. The economic impact of stabilization in place was given very

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- 10.2 superficial treatment, and the impact on the plant construction not stated at all. These important impacts require greater consideration, as it appears that stabilization in place may pose an economic and environmental burden on the people of Salt Lake County in the form of higher drinking water and waste water treatment costs and/or degraded water quality. Furthermore, for a public works project of this magnitude, the EPA construction grants system would conduct a value engineering analysis of the project to identify the most cost effective alternatives and procedures to achieve a given set of goals. We would commend this approach to your attention as well.

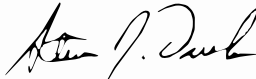
- 6.2 The potential for contamination of groundwater at the Vitro site has been a long term concern as well, and, as noted in the DEIS (page 23), there is inadequate information upon which to project an impact. It is certainly clear that Salt Lake County in general will continue to grow at a rapid rate in the next decade or more, which will make additional demands on land and water resources. It is very likely that groundwater will be utilized more heavily in the future than it is today, as witnessed by the proposal to use a Vitro site well in the community water supply system. Many private wells in proximity to the site are already drawing water from both the deep and shallow aquifers for domestic use. Additional information on this important issue should be made available as part of the NEPA process so it may be subject to the same critical review as the rest of the proposal. We understand that you are developing this information and we feel its inclusion in the final EIS is most important. The integrity of this groundwater data is also important, and we urge you to consider the EPA Quality Assurance Guidelines for all sampling and analyses.

- 2.4 We are aware of the problems of trying to provide final disposal of this large volume of hazardous waste at either site noted in Alternatives 2 or 3. This material, even if it were not uranium mill tailings, would be classified as hazardous waste based on the extraction procedure (EP) test and the metals content. The EPA standards state, "Judgements on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 FR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization. The decision on whether to institute remedial action, what specific action to take, and to what levels an aquifer should be protected or restored should be made on a case-by-case basis taking into account such factors as technical feasibility of improving the aquifer in its hydrogeologic setting, the cost of applicable restorative or protective programs, the present and future value of the aquifer as a water resource, the availability of alternative water supplies, and the degree to which human exposure is likely to occur". It does not appear that the provisions of these standards have been adequately addressed by the DEIS as they specifically apply to the Vitro site and the conceptual design for Alternative 2.

9.1 [There is a tone of uncertainty in the proposals which makes evaluation difficult for both Alternatives 2 and 3. For example, you note that a clay liner "may be required" at either the Vitro site or the South Clive site. Will this determination be made before the FEIS is issued? Since the final disposal/stabilization standards have been issued by EPA, many of these uncertainties should have been resolved by DOE prior to publication of this DEIS. Another question raised by Alternative 2 is the question of soil stability at the Vitro site. Construction at the wastewater treatment plant has necessitated preloading of building sites in order to achieve the required ground stability, and it seems reasonable that this would have to be done for the stabilized pile as well. The effect of this huge mass on nearby buildings or roads is hinted at but never adequately explained. Present construction activities on the treatment plant have also demonstrated the need for constant dewatering, another uncertainty noted in the conceptual design.

6.5 [We thank you for the opportunity to comment on this Draft Environmental Impact Statement. If you have any questions on any points of our review, please don't hesitate to contact Mr. John Giedt of our Radiation Programs Office at FTS 327-6008.

Sincerely yours,


Steven J. Durham
Regional Administrator

Attachment

Specific Comments by EPA Region VIII on the Draft Environmental Impact Statement on Remedial Actions at the Former Vitro Chemical Company Site...

- 8.5 [1. p. 10 The maximum seismic acceleration estimated for both the Vitro site and the South Clive site is 0.2g. Since the Vitro site is so much closer to an active fault, this appears unreasonable. Furthermore the seismic potential is given a very cursory treatment for such an important issue.
- 9.1 [2. p. 11 It is noted that the need for clay liners has not been demonstrated, yet elsewhere it is noted that available information on the groundwater situation (p.23) is incomplete. The decision on clay liners seems premature.
- 19.8 [3. p. 22 paragraph 5, line 1 "affect" should be "affects"
- 6.1 [4. p. 22-23 We assume the final EIS will include data from the studies described in part 3.1.4. We strongly recommend that DOE coordinate its hydrological studies with similar studies by Salt Lake County and USGS which are already in progress, as one of their sampling wells is located just west of the Vitro site. Any hydrologic studies should be done over a monitoring period sufficiently long to determine seasonal fluctuations.
- 14.3 [5. p. 30 The construction impacts of Alternative 2 with the clay liner appear to exceed the impacts of other alternatives in terms of traffic and resultant accidents. This deserves additional attention.
- 17.3 [6. p. 33 Any vegetation chosen for the stabilized pile should be selected with care so that the integrity of the cover material is not breached by deep-rooted plants. There are adapted grasses and forbs which may be useful in this regard to form a permanent sod. The material covering the clay cap should be of sufficient thickness that a saturated zone does not form above the clay, creating a zone which will encourage deep-rooted species. Deep-rooted vegetation can also encourage burrowing rodents. To maintain a healthy plant community, it should be cropped or grazed periodically. Temporary runoff and sediment control measures may be needed for up to three years before adequate plant cover is established.
- 6.2 [7. p. 45 It is flatly stated that either Alternative 2 or 3 would meet the EPA water standards without any further explanation. It is further stated that the ground water systems involved do not contain potable water, yet an on-site well has been proposed for municipal use and there are a number of domestic wells within a half-mile of the site. This should be clarified.
- 19.2 [8. p. 48 "Dave Finerfrock" should be "Dane Finerfrock"

- 9.8 [9. p. 71 Part 4.6.2 references a well "abandoned and capped in the early 1960's." If the statement is literally true, the well should be properly plugged to remove the potential for vertical cross-contamination in the future. The other wells which are not used should also be checked if Alternative 2 is chosen.
- 6.2 [10. p. 72-73 Some deep wells are noted to contain high levels of gross alpha radioactivity, 226- and 228-Ra, and U₃O₈. What is the source of the contamination? Are contaminants present upgradient as well as downgradient?
- 11.5 [11. p. 80 ORNL found "no contamination in Jordan River sediments," but there were studies by Dr. Robert Pendleton tracing contamination for some distance down the river in years past. Can you explain this? Also ORNL found the highest 226-Ra level on-site to be 560 pCi/g, which seems low compared to values measured by others. The exposure rate on the pile itself also seems low compared to past EPA measurements.
- 11.3 [12. p. 106 DOE states that the factors used for the lung cancer incidence from radon daughter exposures overestimate the risk. EPA does not agree but rather contends the estimates used by DOE fall in the low to mid range of those by many groups. BEIR III states that for high LET radiations, the linear hypothesis is less likely to lead to overestimates of risk, and may in fact lead to underestimates. (See EPA's comments on the Canonsburg DEIS risk estimates.) We also disagree (p. 107) that "all doses and health effects would occur within 10 kilometers of the Vitro site". While it is true that the radon from the pile diminishes rapidly with distance from the pile, the effect of that radon on the large population beyond the arbitrary 10 km distance can and should be assessed since even a small incremental dose to a large population will produce a definite population dose.
- 12.1 [12. Since the BEIR III gamma risk estimates are based on misinterpretations of Japanese exposure data (which are now being reassessed), we recommend that until new risk factors are developed, BEIR I or other sources for gamma risk coefficients should be used.
- 12.2 [13. p. 110 Table 5.3 is very confusing, mixing backgrounds and the limits from the EPA standards translated to dose. Furthermore it appears that the proposed, not the final, standards were used for inference.
- 19.2 [14. p. 119 The possibility for the reversal of the present upward groundwater flow is mentioned, but it is simply stated that the effects are unknown. Can't this be modeled to obtain some tentative conclusions?
- 6.2 [15. p. 128 The possibility of restrictions on the placement of building foundations near the stabilized mound is raised. Please explain the reason for this and its potential effect on the CVWRF expansion plans.
- 13.6 [16. p. 129 The loss in lease income to the Central Valley board from the land which would be occupied by the stabilized pile could represent a substantial economic impact when projected over the years the pile will be there, yet this factor is hardly mentioned.
- 10.2 [

- 6.2 [17. p. A-24 The treatment of contaminant mobility seems unduly superficial, since it is likely that acidic, neutral, and basic environments can all exist depending on where in the system the contaminants might be.
- 9.4 [18. p. A-32 Since the slurry wall depends heavily on the maintenance of an upward groundwater flow gradient for containment, the consideration of this option should include a careful review of the potential for flow reversal in the next 200-1000 years.
- 6.2 [19. p. D-8 to 17 Tables D-4 to D-6 show differences between wells sampled at 15-40 feet depth and those at greater than 85 feet depth. Arsenic, boron, iron, magnesium, manganese, sodium, strontium, uranium, gross alpha and beta, thorium, lead, & polonium are present in elevated concentrations in the shallower wells. It should be determined if they are from the pile and if a plume can be defined, as suggested on page 122, before deciding what the impact is on groundwater.
- 10.2 [20. p. E-6 to 10 The projected growth for Salt Lake County and the development of industrial land in South Salt Lake by the year 2000 would seem to make the economic cost of land withdrawal fairly high to the municipality.
- 9.8 [21. p. F-11 "Pb-201" should be "Pb-210"
- 19.3 [22. p. F-14 In common physics and chemistry parlance, "standard temperature" is 0°C, not 70°F.
- 19.4 [23. p. F-19 to the end: Presumably the rest of the monitoring data from the TLD's, etc. will be presented in the final EIS.
- 19.8 [24. p. F-41 "100 m" should be "100 um"

RESOLUTION
83 - 11

A RESOLUTION OBJECTING TO DUMPING CONTAMINATED
VITRO TAILING IN TOOELE COUNTY, UTAH

WHEREAS, the Federal Government through the Department of Energy is considering relocating the uranium tailings from the Vitro Plant located at 3300 South 300 West, Salt Lake City, to Clive, Utah, a location in Tooele County; and,

WHEREAS, the citizens of the City of Tooele do not favor said relocation of these tailings and further recognize the serious economic, environmental and physical harm which our City and County may experience from this relocation and repository of this low level radioactive waste; and,

WHEREAS, by becoming the repository for this nuclear waste, Tooele County will, to a great extent, be limited and prohibited from the future use of these remote lands for other taxable operations, such as, but not limited to, chemical plants; and,

WHEREAS, The Citizens of Tooele City deem it to be in their best interest to minimize this economic impact; and,

WHEREAS, in an attempt to minimize the negative economic impact which shall result from these tailings being relocated and redeposited in Tooele County, and to increase the employment rate within our County.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Tooele, as follows: That the following minimum requirements and conditions shall be met by the Federal Government in relocating the Vitro Tailing to Tooele County; and Congress shall enact as follows:

1. That in the bidding procedures for the facility to be constructed in Tooele County to house the tailing, the transportation of the tailing and any and all other construction related thereto, Utah Licensed contractors shall be given a 5% preferential treatment in all bidding procedures.
2. Further, in addition to the 5% incentive to Utah contractors as stated in No. 1 above, Tooele County Contractors shall be given an additional 5% incentive, in all bidding procedures for

205

Resolution 83-11: A Resolution Objecting to Dumping Contaminated Vitro Tailing in Tooele County, Utah.

Page 2

construction on this project.

3. The Federal Government shall pay to Tooele County as payment in lieu of taxes for the use of the land for these tailings, as well as all land within our County which are impacted and either limited in future development or prohibited from future development, by the placement of these tailings in Tooele County.
4. Payment shall be made to Tooele County at the same or similar rate assessed for chemical plant locations and said sum shall compensate Tooele County for the loss of a potential chemical plant site, and the resulting economic loss to the County and the citizens thereof.
5. All moneys paid by the Federal Government to Tooele County pursuant to No. 3 and No. 4 above shall be distributed to the local governments which represent the citizens of Tooele County.

DATED THIS 6th day of April, 1983

Resolution 83-11: A Resolution Objecting to Dumping
Contaminated Vitro Tailing in Tooele County, Utah

Page 3

TOOELE CITY COUNCIL

(For)

(Against)

<u>Harvey E. Wright</u>	_____
<u>David L. Smith</u>	_____
<u>Raymond Johnson</u>	_____
_____	_____

TOOELE CITY MAYOR

(For)

(Against)

<u>John K. Bluff</u>	_____
ABSTAINING	_____

S E A L

Cynthia Baker
Cynthia Baker, Tooele City Recorder

Approved as to Form: Charles L. Lee

Effective Date: 04-06-83

DAN MARRIOTT
2ND DISTRICT, UTAH

COMMITTEE:
INTERIOR AND INSULAR AFFAIRS
SMALL BUSINESS

COUNTIES:
BEAVER PIUTE
GARFIELD SALT LAKE
KANE TOWNE
JANES WASHINGTON
MILLARD WAYNE

Congress of the United States
House of Representatives
Washington, D.C. 20515

April 7, 1983

Mr. James A. Morley
Project Manager
Uranium Mill Tailings Project Office
U.S. Department of Energy
Post Office Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

It was with great regret that Congressional business in Washington, D.C. prevented me from appearing at the Public Hearings held in Salt Lake, Utah on March 22 & 23. As the site selection for the stabilization of the Uranium Mill Tailings at the old Vitro Chemical Plant is of extreme concern to me, I would appreciate having my testimony included for the official record.

Further, it would be appropriate to note that after hearing of the testimony that was presented during these hearings, I am convinced that the third option presented in the DEIS, the removal of the tailings from the Salt Lake City site and transport to South Clive is of vital importance. This is the only decision which will carry out the intent of the Congressional legislation passed in 1978, P.L. 95-604.

Thank you for your cooperation in this matter.

Sincerely,



Dan Marriott
Member of Congress

DM:bb

206
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(801) 924-4354

206

Testimony of
The Honorable Dan Marriott, MC
Second District -- Utah
regarding
Remedial Actions at the Former Vitro Chemical Company Site
South Salt Lake, Utah
March, 1983

While I regret that Congressional duties will not permit me to attend the series of Public Hearings held by the Department of Energy March 22nd and 23rd, 1983 regarding the Department of Energy's Uranium Mill Tailings remedial Actions in Salt Lake County, Utah, I am pleased to submit testimony for the Environmental Impact Statement studies.

As the record stands, the uranium mill tailings at the old Vitro site has been a problem of concern to me for many, many years. I am extremely upset with the length of time that has elapsed since I was successful in having the Congress pass legislation authorizing the Department of Energy to enter into cooperative agreements with the affected states and Indian tribes in order to establish assessment and remedial action programs at inactive uranium mill tailing sites. This law, Public Law 95-604, "Uranium Mill Tailings Radiation Control Act of 1978" recognized that uranium mill tailings pose a potential health hazard to the public, and charged the U.S. Government, namely the Department of Energy and the Environmental Protection Agency, with the responsibility for promulgating radiological and nonradiological standards for remedial action at inactive mill sites and to enter into agreements with states to

perform remedial actions to bring the radiation levels at sites under their jurisdiction within the EPA standards.

4.1 It was in November, 1979 that the Department of Energy designated this particular site, the Vitro site, as eligible for remedial action under this public law. And, it took until January 30, 1981 for the DOE and State of Utah to enter into the necessary agreement to perform remedial action on the tailings.

During the discussions between the DOE and the State of Utah, a number of potential offsite disposal areas were proposed to allow the Vitro site to be cleaned up and contaminated materials moved elsewhere. The alternative site, proposed by the DOE and State of Utah is 85 miles west of the Vitro site on the eastern edge of the Great Salt Lake Desert, owned by the State of Utah and called South Clive.

9.5 The questions before us today are not only on the need to see remedial action begun in 1983, but are on the need for a permanent, long-term solution, reducing all potential health hazards for the residents of Utah.

20.7 After reading the Draft Environmental Impact Statement issued by the U.S. Department of Energy, February, 1983, I am convinced that while it is possible to stabilize the tailings in place at the old Vitro site, it is NOT possible to stabilize the tailings in place AND protect the environment and public health in perpetuity. Further, the continued presence of the Vitro tailings pile within the Salt Lake metropolitan area represents a blight that will discourage further development and revenues

in Salt Lake. And, I am not alone in my convictions. The State Department of Health, under the direction of Dr. James O. Mason, and the Governor of Utah, Scott M. Matheson, have made this same determination. Together, we hope that you will understand that the intent of the original legislation passed by the United States Congress was for the Federal Government to reach an agreement with the State Government for proper remedial action for ELIMINATION of the recognized health hazards of the inactive uranium mill tailings. The law never intended for the Congress to turn its' back on the issue of States' rights. And this is very much an issue in the debate before us today.

20.1 I urge the Department of Energy's support in having the tailings stabilized at a remote site in the western Utah desert.

At this time, I would now like to back-up my convictions with facts. It was only after consideration of these facts, and asking, repeatedly, the question of the need to protect the environment and public health in perpetuity when looking at each fact, that I reached the conclusion that the tailings have to be moved to an environmentally acceptable remote site, and moved this year.

HEALTH HAZARDS

Over the past 25 years, not only elected officials, but the citizenry of Utah, have expressed grave doubts that the continued location of the uranium mill tailings in a metropolitan area would not only jeopardize potential growth and revenues for the State, but would affect the health of the residents of this metropolitan area, an area with one-third the population of the entire state of Utah.

11.1 When considering the health hazards, you must look at the gamma radiation, the radon gas and all of the subsidiary chemical by-products and wastes left from the milling process at the Vitro plant. These dangers have been recognized and they are known cancer-causing elements. Yet, the hazards are never completely eliminated -- the radiation hazards last and affect both the environment and the people living in the vicinity of these toxic substances. They threaten the lives of people in Utah -- people who never knew of these hazards when they built their homes and established their businesses, or even selected schools for their children to attend.

I am particularly concerned with the physiological hazards caused by the inhalation of radon gas and the associated dust particles. This is directly linked (as supported by the U.S. Surgeon General) to cancer, and in particular, lung cancer. It is 100% fatal.

The EPA standards issued last December require remedial action at both vicinity properties and the tailings pile. But further, it states that "Judgments on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 CFR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

Now, posing the question of the reduction of health hazards, it is clearly an unwise choice to stabilize the tailings at the Vitro plant site.

And, while it is possible to drastically reduce the radiation emanating from the pile; Utahns believe that other environmental concerns are not easily solved and in fact may not be quantifiable. Therefore, unresolved

health and environmental issues will remain should the pile be stabilized in place.

9.5 Remember, the radiation hazard from tailings lasts for many thousands of years, and some nonradioactive toxic chemicals persist indefinitely. While we must look at the immediate health threat, and I applaud both the EPA and the Department of Energy for doing so, the long-range picture must also be considered. The tailings are vulnerable to human misuse and to dispersal by natural forces for an indefinite period. This will lead to possible contamination overshadows that present dangers to the public health.

We must also remember what the original legislation, P.L. 95-604 stated: "uranium mill tailings should be treated...in accordance with the substantial hazard they will present until LONG AFTER EXISTING INSTITUTIONS CAN BE EXPECTED TO LAST IN THEIR PRESENT FORMS." Further, the legislation indicated that the drafters "did not want to visit this problem again with additional aid. The remedial action must be done right the first time."

20.7 And so, I repeat. Let's do it right the first time -- let's not look at only the somewhat less price tag of stabilization on-site to make a determination -- let's not give our grandchildren's grandchildren a more costly problem, both in terms of dollars, but more importantly, in terms of health hazards to their community. And, these are hazards that we can fix properly the first time around.

The Vitro mill tailings pile in Salt Lake is the only abandoned uranium tailings site located in the center of a large metropolitan area. Clearly, the impact on the density of the population cannot be discounted when looking at the questions before us today.

GROUNDWATER

10.1 I am also concerned about the future contamination of the groundwater. Studies have been completed which address the groundwater situation and I believe that they must be looked at further. The Central Valley Water Reclamation Facility is presenting testimony at these hearings by the General Manager, Rodney L. Dahl along with their consulting economist James Weaver. I believe that this testimony goes into depth on the potential hazards for the residents of Salt Lake. And, in their report they indicated that the draft Environmental Impact Statement obviously underemphasized these potential hazards to win favor of on-site stabilization at the Vitro site.

6.2 I implore that the Department of Energy fully reconsider this important aspect prior to the release of the Final Environmental Impact Statement making the determination for a metropolitan stabilization, or one in a remote vicinity.

The statement by the water authorities is valid and I support their assessment of the faulty findings of the original environmental impact statement.

EARTHQUAKES

The Draft EIS does state that the Clive site is geologically superior to the present Vitro plant site in the event of an earthquake. If a major seismic occurrence were to occur at the Vitro site (and the odds of this happening at Vitro is much greater than at Clive), there would be major detrimental effects. Even a minor seismic event could change the ground water regime to the detriment of a stabilized pile with or without a liner

The Draft Environmental Impact Statement proposes a clay liner beneath the tailings if stabilization were to occur on site in an attempt to reduce contamination to the underlying aquifers. Scientists at Utah's Geologic and Mineral Survey and the Utah Department of Health 3.1 have indicated that the long-term integrity of a liner is faulty. The earthquake analysis reported in the draft statement is inadequate, raising questions concerning liner stability during severe ground motions. And then, the ground at the Vitro site would be transforming rapidly and at varying degrees with the placement of large embankments at the site. This could be combated with the covering of an extremely large mound of 6.5 earth for three consecutive years to assure a uniform ground settling. But these costs were not figured into the Draft Impact Statement -- they would increase the project costs tremendously. And I have been informed by the State authorities that Utah requires more restrictive siting and design criteria for a sanitary landfill than the proposal does for stabilizing the Vitro tailings in-place.

Once again, we must ask that question of what is best for the health of our future generations?

10.1 After reviewing the above health hazards, it is easy to see that the determination to stabilize on-site would be a decision based on dollars rather than potential health concerns. Unfortunately, the Draft Environmental Impact Statement did not fully figure-in the dollar-impact of on-site stabilization which, in the long run, would raise the cost of this option substantially.

Department of Energy officials have estimated the cost of stabilization in place at \$22,548,000. Yet, they further indicate that this figure does not include the costs of utility relocation, land acquisition, and other costs associated with ground water control. Figures derived by the Utah Departments of Health and Transportation have placed a more accurate figure of stabilization on-site at

10.1 \$43,315,000 (\$20,827,000 more than the DOE figure).

10.2 Department of Energy officials have estimated the cost of stabilization at a remote site would be \$61,014,000. The Utah Department of Transportation has looked closely at these figures and have assured me that, under current Utah construction costs, the relocation would cost \$53,222,000 (\$7,792,000 less than the DOE figure).

10.2 So we have a possible \$10 million cost difference. Let's look at some other cost-impact data that have great relevance in our discussions here today:

10.3 1. Economic development of the Vitro site. The Utah Department of Economic and Community Development conducted a March, 1983 study and determined that "the sum of capital investment, public revenues, and private sector income resulting from the economic development of the Vitro site would far exceed \$697 million within thirty years if not constrained by on-site stabilization."

2. Employment. This same study indicates that employment generated by site development will "increase from 465 jobs initially to over 900 jobs within 20 years.

3. Private Sector Revenues. Again, quoting from the same March, 1983 study, "the differential cost of stabilization and decontamination (\$38.5 million) will be recovered in public sector revenues alone within ten years; total decontamination costs (\$61 million) will be recovered within eighteen years."

10.3 These figures cannot be negated. They are important not only to this discussion of the remedial action that will be taken by the Department of Energy, but by the economic impact on future Utahns. And, at a time when it is apparent that revenues are needed at the State level to compensate for the lack of dollars at the Federal level, this is a valid argument.

10.2 Considering the negative impacts in a fast-growing metropolitan area, the higher operating costs for the Central Valley Water Reclamation Facility (with the condemned adjoining land and no expansion) and the costs which will be passed along in terms of higher sewage treatment plant costs and higher utility rates for users, the additional revenues from taxes on an industrial center, the cost factor should not be the primary concern. The health factor must be the concern. And looking at the social and health-related problems associated with the location of stabilized tailings in a high-concentration area, huge remedial action costs (both in terms of dollars and health) will be dumped on our future generations. This was not the original intent of the legislation I worked so hard for passage in the 95th Congress. The Federal Government wants the problem fixed right the first time around.

In conclusion, I would like to thank the U.S. Department of Energy for holding these hearings this week. I know that this is a fact-finding mission and that the response from Utahns has been great. I know further that the DOE offices in both Washington and in Albuquerque, New Mexico will have a host of facts and figures acquired at these hearings which must be looked at in depth. These hearings are important.

My wish now is that the Department of Energy roll up its' shirtsleeves and look at the overall health perspective of this issue, taking into consideration, not the short-term health reduction, but the long-term health hazards. This data must be weighed with the nominal difference in costs between the two options being considered. I am sure that the decision reached by the Department will have to take into consideration the potentially legacy that we could be handing our descendants.

While this decision is being made, I want to assure the Department of Energy that I will work closely with them to let the Members of Congress, and in particular, the Members of the Appropriations Committees in both Houses, know of the importance of adequate funding at the present time so that generations from now will not have to go through this process looking to stop dangerous health hazards. During the first week of April, 1983 I will be testifying before the House Energy and Water Appropriations Committee urging that adequate funding be provided for initial action in 1983 and in 1984. I will continue by efforts to ensure that the proper dollars are appropriated to fund the only decision that is before us -- the decision to protect Utahns, both now and in the distant future, from any further health-related incidents from the uranium mill tailings.

We must do the job the first time around. As Governor Matheson indicated, "there may be no second chance...".

In my opening remarks, I expressed my concern with the delay in the implementation of remedial action. I will end my testimony by repeating my concerns and charging the the representatives of the Department of Energy to make a proper and quick decision to once and
 20.1 for all end these consistent delays. The facts have been placed before you. I will be looking forward to working with you for a decontamination of the vitro site and a removal of the uranium mill tailings to a remote area this year. It is the only humane decision.

STATEMENT of RODNEY L. DAHL
 General Manager
 CENTRAL VALLEY WATER RECLAMATION FACILITY
 on behalf of himself
 and the CENTRAL VALLEY WATER RECLAMATION FACILITY BOARD
 supplemented by
 STATEMENT of JAMES WEAVER
 Consulting Economist
 Washington, D.C.

March 23, 1983

Public Hearing to Receive Comments on
 Draft Environmental Impact Statement
 for Remedial Actions at the
 Former Vitro Chemical Company Site
 in Salt Lake County, Utah

INTRODUCTION

My name is Rodney Dahl and I am the General Manager of the Central Valley Water Reclamation Facility. I am here today to enter into the official record of this hearing the comments and position of the Central Valley Board, a local governmental entity, who is the owner of record of the total Vitro Site. My remarks will address the needs of the Central Valley Organization relative to the land development needs of a very large public works facility as well as the long-term uses of the site in the interest of general public in the State of Utah. My remarks will also be supplemented by James Weaver, a consulting economist.

As can be imagined, much review of the Draft Environmental Impact Statement has been conducted, not only by the staff of Central Valley but by outside specialized consultants which have specific expertise in these matters. The Draft Statement review process has not been taken lightly. The serious consequences to the public at large by leaving the mill tailings in place is of considerable concern to those of us who have been given that trusteeship of working in the best interest of the public. There is little question that it is in the best interest of all of the people of the state to remove this health hazard to a remote site where it will have no human health effects or for that matter, no adverse economic effects on the community in which the tailings reside.

I make the comment very often that the Great Salt Lake Valley has only been inhabited for the relatively short period of 135 years. We're now talking about stabilizing a health hazard in the very center of a highly urbanizing valley for 1,000 years if we can imagine that far in advance--that's 50 generations. There are very few, if any, engineered structures in this valley remnant of the pioneer times. As a professional engineer, I submit that any structured stabilization of radio active material located directly adjacent to an existing culinary water supply is doomed to be a long-term health hazard.

The Draft Statement generally complies with Federal National Environmental Policy Act (NEPA) 1970 guidelines in terms of the content

Statement by CVWRF
Page 2

20.7 1.1 required for environmental impact statements except that the required "discussion of how socioeconomic activities and land use changes related to the proposed action conform or conflict with the goals and objectives of approved or proposed Federal, regional, State and local land use plans, policies, and controls for the project area..." (from NEPA 1980) was obviously underemphasized in the Draft Statement to win favor of on-site stabilization at the Vitro site. This will be discussed in some detail.

CENTRAL VALLEY MASTER PLAN OF THE VITRO SITE

13.1 The Draft Statement is good to acknowledge that if the mill tailings are stabilized on site that the Central Valley Board will need to alter its long-term plans for the property owned by the Board. In turn, no long-term alternative solutions are offered. When the Board purchased this property some years ago, it was with the promise from the federal government that it would be immediately cleaned up and that all of this land would be available for Central Valley purposes. The record needs to reflect that the Board purchased this large tract for the specific purpose of constructing a wastewater treatment plant and having adequate land available for long-term expansion. Based on the regionalization concept of construction and the mandate given to us by the United States Environmental Protection Agency, it is expected that these facilities will be the final location for this plant, which serves one-half of the state's most populous county and twenty-two percent of the state's population. Again, the Central Valley Board, serving in a public trusteeship role, purchased this large parcel of land for the specific purpose of serving the public interest. It must be recognized that this land is the last parcel in the center of the valley able to accommodate this specific purpose at the least long-term cost to the public. Let me emphasize that this site was specifically selected to accommodate a long-term need at the least long-term cost. To be required to purchase--which

Statement by CVWRF
Page 3

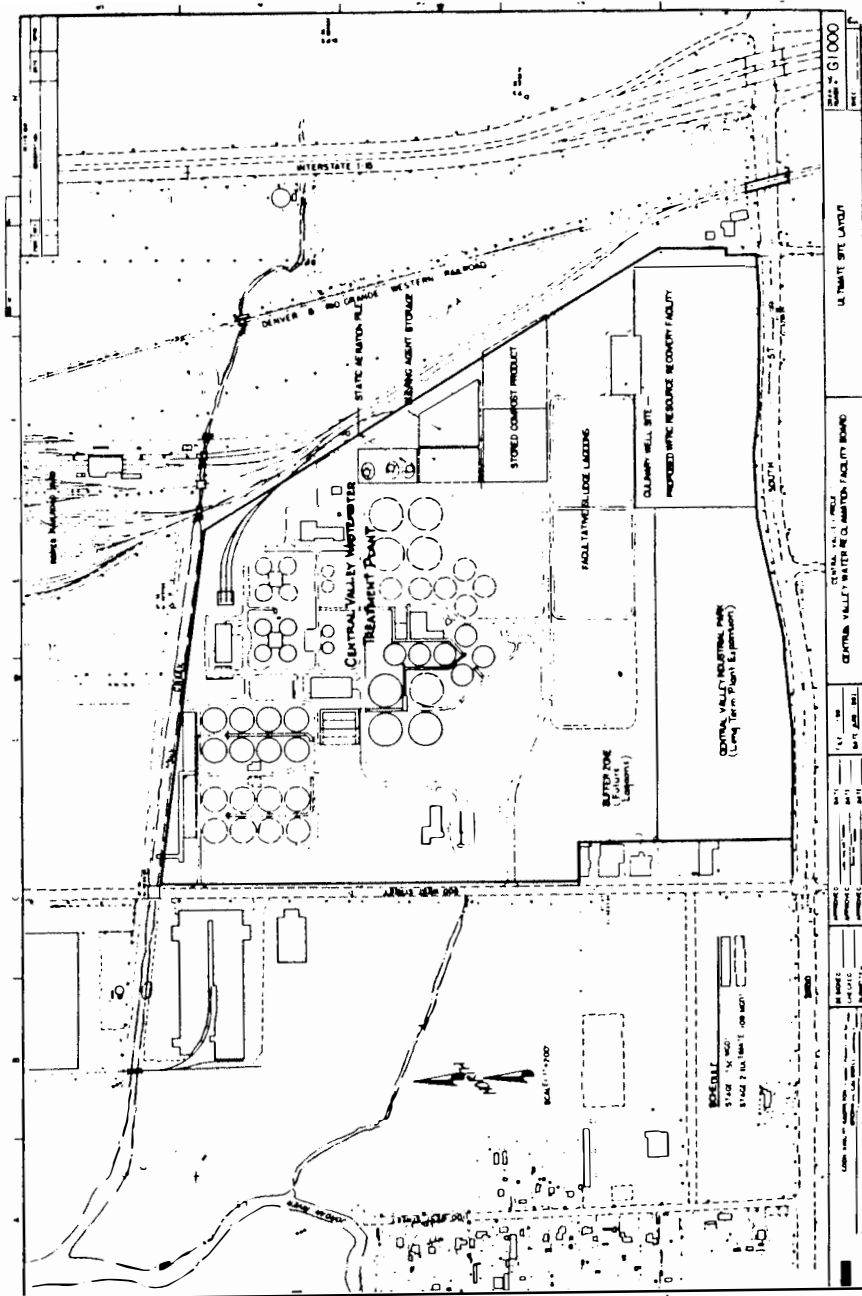
13.1 probabaly means condemnation procedures--adjacent lands to accommodate Central Valley purposes, means to incur additional long-term costs that would not otherwise have to be incurred.

(Slide)

The total Vitro site has been master planned for very specific public uses, both on a short-term and a long-term basis. As previously mentioned, the total site is intended to be utilized in the interest of the public. The ultimate use of the property is three-fold: First and foremost, as a wastewater treatment plant; secondly, to accommodate a resource recovery facility (a garbage burning incinerator); and third, a culinary water well site for the community of South Salt Lake. On the short-term, a portion of the site will be utilized as what I call, a temporary industrial park where the Central Valley Board retains ownership of the land which ultimately becomes long-term treatment plant expansion property many years from now. A side benefit of this industrial park concept is that during its existence, it generates a limited income to the Central Valley Board, which is used to offset the costs of operating and maintaining the treatment plant.

(Slide)

For the record, the following are the intended land uses according to the Board's approved master plan:



Statement by CVWRF
Page 4

TOTAL LAND owned by the Central Valley Board	168 Acres
Land covered by Mill Tailings	128 Acres

Dedicated Land Uses	
°Mechanical Treatment Plant	100 Acres
°Sludge Lagoons (long term)	23-32 Acres
°Temporary Industrial Park (long-term expansion property)	20-25 Acres
°County Resource Recovery Facility	16 Acres
°City Culinary Water Well Site	1 Acre
	160 Acres minimum
	174 Acres maximum

With these figures in mind, it is then easy to visualize that the planned and intended purpose of this land is for the public benefit and that the Central Valley Board made the correct decision years ago to purchase this specific parcel for this specific purpose. It's also easy to visualize that there just plain isn't any property available for stabilization of mill tailings on site.

TECHNICAL ADEQUACY OF THE DRAFT STATEMENT

There are a number of specific areas of shortcomings in the technical adequacy of the Draft Statement. I will not attempt to enumerate all of them during this presentation, as others will have sufficiently covered these items in some detail during this hearing process. But I do have some areas of great concern that should be mentioned.

20.7

There are a number of items left out of the stabilization-in-place estimates which severely skew the decision-making processes into concluding that it is clear that the tailings must remain on site based on large dollar differences between alternative solutions. Specifically, those things identified as not being included in the analysis of alternatives are:

Statement by CVWRF
Page 5

- °Site dewatering costs
- °Replacement of the Vitro Ditch
- °Utility systems relocation
- °Low unit costs of imported clay
- °Road relocation costs
- °Land acquisition costs
- °Leachate monitoring/control systems
- °Life-cycle costing of alternatives
- °Economic evaluation of alternatives
- °No provision for formal value engineering of the final design

Without looking at the economics and life-cycle questions, the above represents in the neighborhood of \$25 million addition to the cost of stabilization in place.

There are also a number of things that could be accomplished to reduce costs which pertain primarily to the stabilization at the Clive Site. Specifically:

- °The use of two unit trains with improved Clive unloading capability instead of three trains.
- °The use of a more common type of train car rather than a specialized car with a car lease rather than purchase.
- °Not installing a clay liner at Clive because the tailings would not be in near proximity to the ground water regime.
- °Abandoning the conveyor system of transporting tailings material which would not work (based on experience on site).

Based on these suggestions, it is fairly apparent that the cost estimate for stabilizing the tailings at Clive can be reduced by many millions of dollars. These are essentially value engineering cost reducing suggestions.

2.4 [The United States Nuclear Regulatory Commission is very specific in its technical requirements for near-surface disposal of nuclear

Statement by CVWRF
Page 6

waste site design. Part 61 says "site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure." Look carefully at that word "isolation" and the statement "need for continuing maintenance." Based on my personal experience and others in the scientific community, there is not a liner available that will guarantee that these mill tailings will remain isolated for 100 years, let alone 1,000 years. This being the case, why not include in the Vitro cost estimate the cost of replacing or major repairs of a liner every fifty years or so? And who's going to pay the bill for repairs and replacements? If the DOE is going to meet the isolation requirement, there's a necessity for a liner on the Vitro site.

2.4 It is the NRC staff's published position "that at a minimum, a 30 meter buffer zone should be maintained on all sides (of the entire area containing waste disposal units)." That requirement would add another 13-15 acres to be purchased for the stabilization on site cost estimate, which also creates additional unresolvable land use deficiencies for the Central Valley Organization.

20 CFR Part 61 also mandates that wastes not be in contact with standing water in the disposal trenches and to be well above maximum seasonal fluctuations in the water table and the zone of capillary rise. Adherence to this rule cannot be met by stabilization on the Vitro Site but can be met at Clive.

6.2 [The recent long-range water supply plan by Salt Lake County water management agencies envisions greater dependence on local groundwater to meet the water supply needs in the next five to ten years. Also, South Salt Lake City fully intends to make full use of their recently acquired well field at the Vitro site. To assume that an upward hydraulic gradient beneath the site will exist over the 1,000 year-design life is unrealistic.

Statement by CVWRF
Page 7

6.2 We concur in the Salt Lake County position which states that the attempted modeling of the groundwater aquifers will not show us anything that good old common sense will not show. Some day there's going to be a negative hydraulic pressure in the aquifers under the Vitro site based on the growth of the valley and the demand made for municipal water. All of us in this hearing may not see that day, but our progeny will.

Sanitary landfills in Utah are required to have active leachate control systems designed to protect groundwater including impervious clay liners (permeability less than 10^{-6} centimeters per second), and leachate collection/treatment systems. Should not the same degree of protection be provided for a nuclear waste repository located in the middle of Salt Lake Valley?

6.5 Based on personal experiences during the on-going construction of the Central Valley wastewater treatment plant, it is evident that the subsurface soil conditions that are expected to be encountered to support a large 3,000,000 ton stabilized pile are quite different than what one would anticipate to find on that site. The soils are much more variable than predicted. Three distinct and maybe simultaneous events may occur under severe soil loading conditions. First, adjacent property subsidence which may affect 3300 South Street, 900 West Street, along with the underground utilities. Secondly, a mud wave on adjacent properties having the same effect as the first mentioned. And, third, interference with normal groundwater flows in the area thereby causing unpredicted surface and subsurface flow characteristics. All of these would have severe and detrimental effects on Central Valley as well as adjacent environs.

The Draft Statement is clear when it states that the Clive site is geologically superior in the event of an earthquake. We agree. We are

Statement by CVWRF
Page 8

8.2 also not aware of any means available to mitigate the detrimental effect of a major seismic occurrence on the Vitro site. It is well understood that the odds of a seismic event happening at Vitro is much greater than at Clive. It must also be remembered that even a minor seismic event could change the groundwater regime to the detriment of a stabilized pile with or without a liner. There are over 100 culinary wells within one-half mile of this site, and the largest user is the municipal system which supports the working force of one-eighth of the population of the state.

1.1 Section 5.11 of the Draft Statement, "Impacts on Economic Structure," clearly does not meet the federal law for preparation of a Draft Statement. This issue will be discussed in some detail later inasmuch as it is one of the three major issues in the evaluation of the stabilization alternatives.

LIFE-CYCLE COSTING OF RECOMMENDED ALTERNATIVES

10.2 One of the significant areas of shortcomings thus far in the decision-making process is that of implementing the value engineering (V.E.) concept into the conceptual, preliminary, and final design processes. My preliminary discussions with DOE personnel indicate that there will not be a V.E. or life-cycle costing analysis completed prior to the record of decision being made. I don't know how the DOE does business, but the EPA will not allow a large construction project to move ahead without at least two very detailed value engineering analyses being completed during the course of the project design. I know. I am in the process of constructing a \$100 million wastewater treatment plant on the Vitro site. The three V.E. sessions conducted on my project have saved many millions of dollars to the public.

2.4 In some instances, what has been identified as the most expensive alternative to construct becomes the least cost alternative in the long

Statement by CVWRF
Page 9

term during the value engineering analysis. Some of the many factors that would have an influence on this analysis would be:

- *Cost of operation and maintenance
- *Replacement costs
- *Inherent risks and probabilities of failures
- *Dollars lost to the public through misplacement of the structure

In the case of stabilization of mill tailings on the Vitro site, the least capital cost alternative, it is apparent that this alternative is the most costly using a value engineering analysis.

Over the past months, I have been quoting the results of an in-house value engineering analysis which needs to be reiterated here. Using standard government value engineering or life-cycle costing techniques, the payback of the cost to move tailings to Tooele County will occur somewhere between nine and ten years. Now it is recognized that the site cleared is a good decision even though it is initially the most expensive.

We have now had the opportunity to relook at this question of the potential economic impacts of the Vitro site if the tailings were not stabilized in place which can accrue to Salt Lake County using a cost-benefit perspective.

(Introduction of Jim Weaver)

ECONOMIC EVALUATIONS

My name is Jim Weaver. I am Chief Economist for Engineering Science, a worldwide firm of scientists and engineers engaged in a wide variety of environmental engineering projects for Government and Industry. I have been retained by the Central Valley Water Reclamation Facility Board

Statement by CVWRF
Page 10

(CVWRFB) to review the Draft Environmental Impact Statement, which is the subject of these hearings today. The principal goal of this review was to provide CVWRFB with an objective appraisal of the economic evaluation of alternatives set forth in the Draft EIS. The remarks I will make today represent the preliminary findings of my review.

The Draft EIS sets forth an evaluation of alternatives for correcting public health hazards associated with uranium mine tailings at the Vitro Site. The DOE authors assert, at least implicitly, that compliance with recent EPA regulations concerning clean up of open lands and buildings provides the appropriate basis for determining how much cleanup it would jointly undertake with the State of Utah, as provided for by UMRCA (PL95-604). The comparison of alternatives in the Draft EIS is performed using the cost effectiveness principle which states that the alternative which attains compliance cheapest is the most preferred.

Without commenting on the legal question of whether meeting the EPA regulations amounts to the appropriate definition of responsibility, I will argue that the cost effectiveness analysis presented in the Draft EIS is seriously deficient. I would like to review a broad list of excluded costs which both undermine the conclusions reached in the Draft EIS and which further call into the question for the usefulness cost effectiveness principle employed therein.

As is nearly always the case in matters relating to health and environmental protection, the costs to society are much greater than "engineering" costs of cleanup. In the Vitro case, the cost of doing nothing about the tailings is not zero, but the sum of a long list of public and private damages resulting from the real or perceived dangers associated with living in close proximity to the wastes. The analyst who uses a cost effectiveness criteria for determining how to meet specified cleanup levels seldom evaluates such damages because the clean-

Statement by CVWRF
Page 11

up regulations seldom require their inclusion. However, to the great credit of EIS regulations, such external costs and damages are to be included in the evaluation of alternatives. In the analysis provided in this Draft EIS, they have been treated much too cursorily or not at all.

Let me review some of the most obvious oversights.

1. Increased Costs of Operation

The Central Valley Water Reclamation Facility Board (CVWRFB) will face certain increases in operating costs if Vitro lands are partially cleared and stabilized. Since land is required as a means for disposing sludge, any lost land area will mean additional outlays will be made to either develop sludge disposal sites elsewhere and/or install extensive sludge dewatering facilities. Inasmuch as CVWRFB purchased the Vitro land with full expectation that the tailings would be cleared by DOE, this amounts to a "taking" of beneficial land value, the cost of which will ultimately be passed on to Central Valley customers in the form of higher fees or special assessments.

10.2 2. Loss of Resource Recovery Benefits

Under the partial clearing alternative, a Resource Recovery Facility will not be built because cleared land will have to be devoted to uses with higher value to CVWRFB, namely sludge disposal. The loss of benefits resulting from this cancellation amounts to a further loss to CVWRFB. Since these benefits would have been available to offset operating costs, their loss will also be felt by Central Valley rate payers.

3. Forgone Lease Revenue

The prevailing and forecasted use of land in the vicinity of Vitro is light commercial. CVWRFB has planned a 20 - 25 acre industrial park

Statement by CVWRF
Page 12

development for part of the Vitro Site which would be prevented if the Vitro Site were only partially cleared. If the present worth of all future returns to land is reflected by current selling prices for otherwise equivalently "endowed" land, then CVWRFB's forgone lease benefit in present worth terms could be in the vicinity of \$200,000/acre or \$4,500,000. If the Vitro industrial park were developed, there would be additional economic returns to its developers, and the suppliers of goods and services who either directly or indirectly serve these industries.

4. Other Property Losses

10.2

Both the real and perceived health risks of being close to the Vitro mill tailings have caused fear among those who live and work near the Vitro Site. It is likely that these concerns have depressed property values in the vicinity of Vitro. The Draft EIS should more adequately assess the range of possible impact for this effect. Econometric regression techniques have been used widely for this purpose, using data concerning property characteristics and selling price which are typically recorded for property transactions.

It is easy to see that such impacts may be large. Let me state a hypothetical case which may clarify this point. Assuming an affected area of 500 acres and a cost impact distribution such that annual land values were depressed 5 percent in 80 percent of the area, 10 percent in 15 percent of the area, and 50 percent in 5 percent of the area, and average land values were \$100,000/acre, then the total present worth impact would be as large as \$4,000,000. This value is, of course, entirely speculative but is plausible enough that it should compel a far more serious analysis to be provided in the Draft EIS.

Statement by CVWRF
Page 13

5. Health Damages

The value of life is the least tractable of all economic issues surrounding the Vitro issue. Is there a finite range to human life value? Are all lives worth the same? Who says how much each is worth? Although economists have been able to find imputed values of human lives by examining the amount governments are willing to spend to save lives (for example by outlays for highway improvements with known mortality prevention rates), or by calculating the present value of lifetime earnings, few believe seriously that such estimates capture all the value of an individual in any social context. Further complicating this issue is the inclusion of future generations in the evaluation. In this issue, the welfare of the next 10 to 50 generations is a stake. Should the value of future generations be discounted?

Whatever the values used, they are clearly great. Yet treating them only "subjectively" (that is unquantified), as does the Draft, has resulted in too little consideration in the review of alternatives. The Draft asserts that 0.8 new cancers would occur per year with no remedial action, and implementation of either on-site or off-site stabilization apparently results in a near-zero cancer rate. Too easily assumed is that there will be 100 percent certainty of stabilization systems working throughout the 200 - 1000 year period and that there is 100 percent certainty that no future findings about mill tailing epidemiology that will alter cancer risk assessments. It is relevant to note in the 30 years or so since limits have been set for occupational radiation exposure, nearly every time limits were reviewed for adequacy, they were lowered. It would appear a very questionable, although plausible, assumption to make that in 200 - 1000 years, no new discoveries will be made about mine tailing health impacts which would cause us to revise our expectations about public health damage.

Statement by CVWRF
Page 14

Conclusions

I believe that the sum of these costs, namely the sum of

- *Increased Operating Costs for CVWRFB,
- *Lost Benefits from the Resource Recovery Facility
- *Forgone Revenues from a planned industrial park
- *Property Losses in the Vitro vicinity, and
- *Health Damage Risks,

is very high. A preliminary estimate for only two of these five cost categories already approaches 10 million dollars. When combined with a \$25-million estimate for engineering cost oversights, it is apparent that the alleged cost advantage of the "stabilization-in-place" alternative is already eliminated.

- 1.1 [It is my conclusion that the economic analysis provided in the EIS is totally inadequate for making the important social decision of how best to manage Vitro mine tailing waste. The cost categories described above should be carefully analyzed in revising the Draft EIS.

CONCLUSIONS

For the transcript record, I am Rodney Dahl.

- 10.2 [In summary, we have presented here, today, enough evidence on the real economics of the tailings removed and the inherent risks of leaving the tailings in place that it should not be difficult to make the decision to move the tailings to a remote site for stabilization. I have prepared two tables for review that will conclusively illustrate how easy it is to make the decision to move.

(Slide - Table 1, "Health Risk Factor Analysis")

(Slide - Table 2, "Site Development Analysis")

Table 1

Health Risk Factor Analysis

	<u>Vitro</u>	<u>Clive</u>
Potential Seismic Activity Affecting the Stabilized Pile	High	Low
Groundwater Flows in Proximity to Stabilized Pile	Extreme	None
Underground Culinary Water Sources in Proximity to Stabilized Pile	Extreme	None
Nearby Groundwater Ability to be Used for Municipal and Industrial Purposes	Extreme	None
Stabilized Pile in Proximity to Known-Municipal and Private Culinary Wells	Extreme	None
Known General Flooding of Site from Nearby Drainage Channels	High	None
Stabilized Pile Located in Identified Flood Drainage Basin	Moderate	None
Ability to Protect Against Stabilized Pile Becoming a Health Hazard to the Community in which it Resides	Perhaps	Yes

Table 2

Site Development Analysis

	<u>Vitro</u>	<u>Clive</u>
Stabilized Pile Located on Land Previously Identified for Development	Yes	No
Public Works Project	Yes	No
Commercial/Industrial	No	Yes
Grazing/Recreation		
Site Can Contribute to the Economic Well-Being of the Community	Yes	No
Stabilized Pile to be Maintenance Free on a Long-Term Basis (that is, no close monitoring because of close proximity to culinary water sources or other health-risk factors)	No	Yes
Geologically Superior in the Event of Earthquake	No	Yes
Site in Close Proximity to Existing and Future Utility Systems	Yes	No
Necessity of a Long-term Leachate-Monitoring System to Adequately Protect the Potential Community Water Supply	Yes	No

Statement by CVWRF
Page 15

Based on my most recent discussions with the Technical Assistance Contractor, if the tailings were to be stabilized on site, the taking of land would be some nine acres less than proposed in the Draft Statement. To some degree, that's good; but on the other hand, imagine yourself standing on 900 West Street and viewing a permanent mill tailings pile some 45 feet high--4 1/2 stories. Now that's some monument to a giant federal mistake. How long would you imagine it will take to get the Golden Fleece Award?

Those good folks in Tooele County are very concerned about getting the tailings as far away from them as possible and yet to keep the tailings as environmentally safe as possible. We agree with that concept. The move to Clive serves both purposes and adds the additional safety factor of one additional mountain range between Tooele's population centers and the stabilized pile. For them, the distance to Clive is greater than the distance to South Salt Lake.

It's interesting to me to note that those who have the responsibility for preparing this Draft Statement and, for that matter, those who will make the decision as to how these tailings are to be stabilized are all from out of the Salt Lake area and are not very familiar with the seismic timebomb that we in this Valley live with every day. If you lived here and were really familiar with the Wasatch Fault threat, the decision to move the tailings would be easy. If there is a major earthquake in this valley and it does breach the pile on the Vitro site, it would probably be months before it is recognized that one of our major culinary water sources is irreparably damaged--likely to the point where who knows how many people have been contaminated.

We have had the opportunity to discuss the various issues that are clearly not well enumerated in the Draft Statement before this hearing today. The Central Valley master plan and surrounding land use inten-

Statement by CVWRF
Page 16

tions are in conflict with stabilization in place. There are some severe technical inadequacies that are reviewed here as well as by others. Life-cycle costing of alternatives must be an important element in the decisions to remove the tailings from the Vitro site. The economic evaluations show clearly that it is in the best interest of the public to return the Vitro site to its highest and best use, again to remove the tailings to an environmentally sound desirable location.

The congressional report which accompanied the federal law for this remedial action program states clearly that "the Committee believes that the uranium mill tailings should be treated. . .in accordance with the substantial hazard that they will represent until long after existing institutions can be expected to last in the present form. . . ." Note that this mandate cannot possibly be met with the tailings in an urbanizing area. This alone says move the tailings regardless of the costs.

It cannot be emphasized enough that the primary intended use of the total Vitro site is to accommodate a worthwhile public purpose. A decision to stabilize the tailings in place would be an unfortunate one in that it would jeopardize the true foresight and the public trusteeship of local elected officials.

Thank you.

April 8, 1983

Memo to: Mr. James A. Morley, Project Manager

From: Salt Lake City-County Board of Health

Re: Vitro Resolution

Attached, for your information, is a copy of a resolution passed April 7, 1983 by the Salt Lake City-County Board of Health. It is our position that stabilization in place, as presented in the DEIS is "fatally flawed", and that such a solution is unacceptable.

RESOLUTION

WHEREAS, the Salt Lake City-County Board of Health has studied the health effects of the Vitro tailings, and

WHEREAS, the Salt Lake City-County Board of Health has studied the proposed remedial action alternatives set forth in the Draft Environmental Impact Statement (DEIS) issued by the U.S. Department of Energy, and

WHEREAS, it is recognized that radiation from inhaled radon daughter particles, as are released from the Vitro tailings, has been established as a cause of lung cancer in both man and animals, and

WHEREAS, the tailings constitute a substantial quantity of a low level radioactive material, exposure to which is unnecessary and not in the interest of public health, and

WHEREAS, the numerous heavy metals and related compounds in the tailings constitute a significant and permanent threat to the surrounding groundwater systems, and

WHEREAS, (1) The tailings constitute a hazardous waste, and (2) were the tailings not now at the Vitro site, the Vitro site would not have been suggested as a permanent hazardous waste site as it fails the rigid selection criteria for such sites, and

WHEREAS, Congress clearly required that permanent solutions be implemented in funding remedial actions, and

WHEREAS, the concepts and designs set forth in the DEIS for on-site stabilization at Vitro, in all suggested variations, do not provide an adequate, permanent, or certain solution to the problem.

NOW THEREFORE BE IT RESOLVED that the Salt Lake City-County Board of Health does hereby adopt the position that on-site stabilization as proposed by the Department of Energy is "fatally flawed", and that such a solution is unacceptable. We are opposed to the permanent establishment of a 3,400,000 ton hazardous waste site within Salt Lake County. Furthermore, the only adequate and acceptable solution to the problem is removal of and proper stabilization of the tailings at a suitable location, such as is proposed in the third DEIS alternative of relocating the tailings to the South Clive Site.

Dated this 7th day of April, 1983

SALT LAKE CITY-COUNTY BOARD OF HEALTH

by Wayne I. Baer
WAYNE I. BAER, CHAIRMAN



APR 25 1 43 PM '83

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY
84114

April 8, 1983

The Honorable Donald P. Hodel
Secretary of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Secretary:

The residents of Utah, perhaps as much as those of any other state, have participated in the tremendous scientific and technological advances fostered by the federal government in the nuclear arena. The Vitro Chemical Company plant was one of those ventures. For 14 years, the federal government and the citizens of the state of Utah shared the industrial output and economic benefits of the Vitro plant.

However, since the termination of operations at the plant in 1968, the tailings and other toxic contaminants left at the site have posed an increasing threat to the health and safety of residents of the Salt Lake valley where nearly one-half of the total population of our state resides. In addition, the resulting aesthetic blight and building restrictions imposed by the presence of the waste have prevented the development of prime industrial property. In 1978 Congress provided a means for solving these problems when it passed the Uranium Mill Tailings Remedial Action Act

The Draft Environmental Impact Statement on the Remedial Actions at the Former Vitro Chemical Company Site was prepared for the purpose of taking a hard look at environmental consequences of alternatives proposed for implementing this act. The two key solutions are removal to a remote area and stabilization on-site, both of which I have carefully reviewed. My conclusion is that the state of Utah cannot concur with on-site stabilization as an acceptable means of dealing with the contamination at the Vitro site. The only acceptable alternative under consideration is the removal of the tailings to a remote, environmentally safe site.

The Department of Energy appears, however, to implicitly identify stabilization on the Vitro site as the preferred alternative, a complete reversal of the previous DOE position. This change of direction is apparently based upon the economic conclusion that stabilization on-site provides a cheaper alternative. Our attached technical comments challenge not only the health and safety conclusions of the DOE, but also the data and methods used to arrive at cost estimates. It is our opinion that serious miscalculations have occurred regarding the current and future threats the wastes pose to the

human environment and the one-time costs of implementing the various alternatives. Furthermore, the long term costs to society over the thousand year planning cycle are not even considered in the DEIS.

The application of theoretically sound technology oftentimes has unanticipated and imperfect results. We in Utah have repeatedly relied upon the judgment of the federal government as to the safety of various nuclear related activities, only to realize later the error in judgment. The latent problems which are surfacing with the Vitro tailings pile is one example, but with a difference: we have the opportunity to remedy the problem before further errors in judgment have serious human impact.

The opportunity for assuring the greatest safety for the Utah public lies in implementation of the alternative of removal to a safe, remote site. The cooperative agreement between the DOE and the state of Utah requires state concurrence in the alternative selected. The only alternative with which the state can concur is that which provides the safest and surest remedy to the problem at hand.

In the spirit of the cooperative agreement, and the need for immediate resolution of the Vitro tailings question, I urge you to select removal as the course of remedial action. We have shared the economic and social benefits brought about by this development. We must now begin the immediate relocation of the tailings before we are faced with sharing the responsibility for potentially tragic impacts to Utah residents.

Sincerely,

Governor

SMI: jc

I. GENERAL COMMENTS

COMMENTS OF THE STATE OF UTAH
on the
DRAFT ENVIRONMENTAL IMPACT STATEMENT:
REMEDIAL ACTIONS AT THE FORMER VITRO CHEMICAL COMPANY SITE
SOUTH SALT LAKE, SALT LAKE COUNTY, UTAH

April 6, 1983

- 20.1 [The state of Utah maintains that both the tailings and the other contaminated materials located at the Vitro site must be moved to a remote area. It is not possible to stabilize the tailings in place and protect the environment and public health into perpetuity. In addition, the aesthetic blight and zoning restrictions which would result from on-site stabilization would preclude realization of the full economic potential from development of the Vitro site and the surrounding properties. For these and other reasons listed below, Alternative 3 -- Stabilization at the South Clive site, as described in the Draft Environmental Impact Statement: Remedial Actions at the Former Vitro Chemical Company Site, is the preferred alternative of the state of Utah. This policy is in keeping with the position previously taken by the state of Utah.
- 13.2 [
- 13.3 [

- 8.3 [In the draft EIS, the U.S. Department of Energy consistently underestimates the potential threat to public health and safety. Errors occur in several areas. Serious miscalculations render the seismic analysis invalid. The extent of current and potential groundwater contamination is also significantly underestimated. The hazardous effects of various heavy metals and other nonradioactive contaminants are not considered. Finally, the economic evaluations which were performed consistently overestimate the costs associated with removal of the tailings and other contaminants to the South Clive site, and underestimate the cost of on-site stabilization.
- 14.2 [
- 1.1 [

- 20.2 [Furthermore, by failing to consider the full-range of economic costs and benefits accruing during the entire 1000 year planning cycle, the DOE underestimates the costs of stabilizing the tailings at the Vitro site. Such costs will accrue due to the loss of public revenues and associated opportunity costs if the wastes are stabilized at the Vitro site. Consideration of these lost opportunity costs indicates that both the federal government and the state of Utah will recover a major portion of their tailings removal costs within 30 years.
- 10.2 [

The failure of the DOE to utilize a long-term economic model has also resulted in a lack of consideration of the private sector income and job opportunities which could be realized if the wastes were moved to a remote site, allowing the full economic potential of the Vitro site and the surrounding properties to be developed. An analysis of these and other economic factors is offered in Economic Impacts of Alternative Remedial Actions for the Vitro Tailings, a Utah Division of Community Development report which accompanies these comments.

- 5.2 [Another major concern of the state of Utah is the implicit change in direction the DOE has taken from the concept paper generated during early consideration of the Vitro issue. In the June 1981 Remedial Action Concept Paper, the department agreed with the state that removal of the tailings to a remote locale was the preferred alternative. Less than a year later in a revised document, the DOE reversed its position, maintaining that on-site stabilization was its preferred alternative. This sudden reversal has caused serious problems for local government, especially planning and zoning activities. It is the state's position that this change is unjustified and unsupported in the draft EIS.
- 1.2 [

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act state that the purpose of an EIS is to "...provide full and fair discussion of significant environmental impacts."

The state of Utah feels that the draft EIS has failed to meet the CEQ guidelines as outlined below.

- Furthermore, the draft EIS fails to satisfy the spirit and intent of the Uranium Mill Tailings Radiation Control Act of 1978. This occurs in two key areas. First, it is clear that Congress intended remedial actions to consist of a one-time solution to problems. On-site stabilization (as implicitly recommended by the DOE) would not accomplish this, but rather, leaves the ultimate solution to the future, after sustained generation of adverse socioeconomic impacts has occurred and funding for remedial action is no longer available. Second, the Act anticipates a mutually satisfactory course of action through the implementation of a cooperative agreement. The implicit preference found in the draft EIS does not accomplish a mutually satisfactory resolution of the problem.
- 3.1 []
- 20.7 [] Finally, in keeping with the cooperative agreement, the state should be fully involved in the development of the final EIS.

SPECIFIC COMMENTS

Forward, paragraph 3

Change in designs may be needed to conform to changes in the final EPA standards for remedial action at inactive uranium mill tailings sites. The final EIS should stipulate that such changes will be reviewed and approved under the provisions of NEPA.

- 6.1 [] A lack of adequate data to predict either the probability of future groundwater contamination or groundwater use patterns is mentioned. The referenced additional groundwater investigations are inadequate in design and of too short duration to fill in the existing gaps in the data base.

Page 5. - 1.2.2

- 20.9 [] DOE is responsible for actual acquisition of the 69 acres. The state of Utah recognizes its responsibility to pay 10 percent of all agreed upon costs, but will not undertake responsibility for actual acquisition of the realty in question.

Page 6 - Table 1-1

- 10.1 [] The total cost of Alternative 2 is underestimated by as much as \$20.5 million (see also p. 54 - Table A-17 comments).
- [] The total cost of Alternative 3 is overestimated by \$8 million (see also pp. A-90 & A-91).

Pages 5 and 8

Because the DOE analysis considered different stabilization regimes at the Vitro site (stabilized mound) and the South Clive site (partial burial), a direct cost-benefit comparison is not appropriate. The state of Utah

- 9.8 [] believes that partial burial represents state of the art technology and offers superior benefits in terms of public health and safety. This further increases the attractiveness of the South Clive alternative.

Page 9 - paragraph 2

- 5.2 [] It should be noted that a building moratorium for several years halted development in the vicinity of the Vitro site. This moratorium was relaxed by Salt Lake County only after assurances by the DOE that the wastes would be removed.

Page 11 - 1.4

- 9.1 [] The draft EIS states that "[t]he need for clay liners has not been demonstrated." This issue must be addressed before any siting decisions are made. The state believes that clay is an essential component of a stabilization structure. In fact, with the tailings presently in contact with the groundwater, Utah believes that on-site stabilization cannot be seriously considered as an option which will suffice for even the 200-year minimum period, as specified in the EPA standards. However, even with the addition of a clay liner at the Vitro site will not guarantee the integrity of the stabilization structure due to the sheering effect of the soils. (See also comments p. A-35, para. 2.) Since natural clay goes to a depth of 20-25 feet at the South Clive site, an additional lining of clay may not be necessary.

Pages 12 and 13 - Table 1-3

- 19.7 [] The alternative project costs presented in Table 1-3 are not realistic. In developing these cost projections, the DOE has not applied the same criteria or regiment to stabilization on-site (Alternative 2) and stabilization at the South Clive site (Alternative 3). Furthermore, the radiological effects are not correctly expressed in cumulative terms for Alternative 1. Mathematical discrepancies exist between Tables 1-1, 1-2 and 1-3 for Alternatives 2 and 3.

Page 14, last paragraph

- 10.2 [] The cost estimates presented for the alternatives are incomplete. No attempt has been made to estimate life-cycle costs, which would show the true societal cost over the 1000 year planning cycle. Even when a 30-year social-cost estimating model is employed, the lost opportunity costs associated with industrial and commercial development at the Vitro site is greater than the difference in cost between Alternative 2 and Alternative 3. This holds true for both the DOE's and the State of Utah's cost difference estimates in implementing the two alternatives.

Page 15, last paragraph

The following portion of the Congressional report accompanying the Uranium Mill Tailings Radiation Control Act of 1978 should augment the explanation of the Act in the Final EIS, since it more clearly reflects the intent of the Congress in the legislation:

- 9.5 "The committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms. ...The committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."(emphasis added).

Page 16, paragraphs 2 and 3

Health effects are estimated in the statement, "... calculations suggest that the Vitro site contamination might produce 0.7 to 0.8 fatal cancers ...". The additional 740 to 850 additional cancer induced deaths over the 1000 year planning cycle have economic costs which must be specifically addressed in the final EIS.

Page 16, paragraph 4

- 6.2 Here, as well as throughout the draft EIS, the potential health effects of the other toxic substances remaining in the Vitro tailings are ignored. The state of Utah believes that these heavy metals represent at least as great a health hazard to the underlying aquifers as the radionuclides.

Pages 19, 20 and 21 - 3.1.1 - Tables 3-1 and 3-2

The presence of significant levels of nonradioactive toxic substances in the wastes dictates that an appropriate site be found. The Vitro site would not qualify under state and federal standards as a hazardous waste site. In fact, the site fails to meet even state and federal standards for the disposal of common solid wastes.

Page 30 - 3.2.3.1, paragraph 1

- 9.8 The method, as described by the statement, "[t]he water produced during emplacement could be temporarily stored in sumps near the excavations and pumped back into the excavated area after the granular working base is in place.", should not be employed in the preparation of the lined stabilization area. Any attempt to place a clay liner over a working base in which excess groundwater has been pumped will fail. Also, the groundwater will be further contaminated by the tailings.

Page 45, paragraph 4

- 6.3 The statements, "Alternatives 2 and 3 would not differ in their radiological and nonradiological impact on ground- and surface-water quality. Either alternative would meet the EPA standards. In any case, the ground- and surface-water systems involved do not contain potable water." are inaccurate. Within a one-half mile radius of the Vitro site there are 120 wells. Forty of these wells are less than 120 feet deep and are being used for irrigation and stock watering. Many of the contaminants present in the tailings could enter the food chain through these sources.

Page 58 and Table 4-1

- 8.3 The May 22, 1910 earthquake was probably at about 40°44.94' and 111°50.95', well south of Bountiful and about 5 km from the Vitro site. It had an estimated magnitude of 5.7. The November 10, 1884 earthquake was not in Bountiful, but near the Utah-Idaho border. The March 28, 1975 event was in Pocatello Valley, not Pocatello, Idaho. Damage reports clearly indicate that the December 1, 1958 earthquake was near Nephi. The errors in pinpointing the locations of the latter three events is around 100 km. These gross errors negate the validity of the seismic risk analysis.

Page 59

- 8.6 A critical structure such as that proposed for the Vitro site should anticipate a magnitude 7.5 event occurring in the Salt Lake Valley.
- 8.4 It is the opinion of the Utah Geological and Mineral Survey that most of the earthquakes in Utah cannot be correlated with surface faults. The reference that maintains that "...90 percent of the earthquakes which occurred in Utah between 1950 and 1965 were located along or in association with known fault zones." should be verified.
- 19.9 The figure for horizontal acceleration is 21% g or 0.21 g, but cannot be 0.21% g, as indicated in the text.
- 8.5 The Vitro site is not located on rock, which invalidates the 21% g estimate.
- The USGS assigns a value of 27% g for Wasatch Front horizontal bedrock acceleration, which has a 90 percent probability of not being exceeded during a 50-year period. However, the 50-year standard used for construction purposes is not applicable to the Vitro disposal configuration. A more reasonable approach for the Vitro site is use of the 250-year standard. For bedrock, the value would be 60% g. This comment is also applicable to page 116.

Page 63

- 8.6 The statement, "[e]ach of these earthquakes was of a magnitude comparable with what might be expected to be the maximum event produced by the faulting along the front of the Wasatch Range." is inaccurate according to the Utah Geological Mineral Survey.

Page 64

It is unlikely that evapotranspiration will occur, since the water table lies between 25 and 35 feet in depth.

Page 64

Recreational use of the Jordan River should be considered "beneficial".

Page 72

6.2 The high levels of radium-226 and radium-228 in the deep, partially-confined groundwater system may be due to the earlier mining and milling activities at the Vitro site. If so, leaving the wastes at the site could further increase these above-standard radium levels.

6.2 "The piezometric levels in March and April 1982, as measured in monitoring wells drilled to a depth of approximately 60 feet, ranged from 1.0 to 12.0 feet above the existing ground surface. As a result, deep wells within the Vitro area are artesian and flow at the surface." When the city of South Salt Lake begins pumping their deep, 830-foot well at the Vitro site, the artesian conditions will change a great deal. With the deep aquifer being only "partially-confined" (as indicated in the draft EIS), a serious contamination potential will exist.

Page 73

11.5 Several issues raised on this page warrant further investigation before any decisions are made. For example, have any of the 121 domestic wells located within a one-half mile radius of the Vitro site been tested for evidence of contamination? If the upper groundwater system (and possibly the deeper system) are contaminated, to what extent has the contamination plume migrated offsite, and what are its potential health affects?

The DOE's current studies are not adequately designed to address the remaining hydrologic concerns. For example, the South Clive site is described as being hydrologically similar to the Vitro site, but only one groundwater system is mentioned. Is there also a deeper, partially-confined groundwater system at the South Clive site, and if so, what are its characteristics?

Page 74

19.5 "May" should be changed to will in the statement, "[t]he high salinity of the ground water in the South Clive area may limit its use...".

Page 114. 5.3.1, paragraph 2

The text mentions acquisition of "[a] 5.4 acre strip adjacent to the southwest side...". However, the draft EIS fails to mention the need to acquire 63.6 acres of property from the CVWRF Board.

Page 116 (see also page 59 comments)

19.6 A discrepancy exists between the 23% g acceleration value found on page 116 and the 21% g value given on page 59. Would the final acceleration estimate then be 18% g?

The Proceedings of Conference Ten, Earthquake Hazards Along the Wasatch and Sierra-Nevada Frontal Fault Zones, convened under the auspices of the National Earthquake Hazards Reduction Program (1979), concluded: "If data from the complete earthquake catalogue (1850-1978) are used, they indicate return periods for the Wasatch Front area (92,810 sq. km) of 22 to 25 years for events of 6.0 on the scale, 111 to 115 years for 7.0 events and

232 to 263 years for 7.5 events." The conclusion to these proceedings adds: "Comparison of ratios of velocity spectra between rock and alluvium, in the period ranges of most interest in risk analysis, suggests that ground response at sites on thick saturated alluvium such as exists beneath large parts of the Salt Lake city area can be ten times greater than at adjacent rock sites." This comment should be referenced with the Page 59 comment regarding structure design at the Vitro site.

Page 118

9.2 The statement, "[f]or transient loading conditions, such as the ones imposed by earthquakes, acceptable factors of safety range from 1.0 to 1.3." is incorrect. It is also in conflict with p. A-69, which indicates that a factor of safety "of 1.5, ... is generally accepted as the recommended minimum to insure stability."

Page 119, 5.4.2 - Impacts on groundwater

This aspect is not adequately addressed in the draft EIS. The Vitro site is underlain by a thick sequence of unconsolidated Quaternary deposits. Bedrock below the site (which is buried under a thick sequence of alluvial deposits to at least 500 feet) consists of semiconsolidated clay, sand and gravel, interspersed with lava and cemented layers of sand and gravel. Within the unconsolidated section, two interrelated (but separate) groundwater flow systems have been identified. There is a shallow watertable system which occurs within the upper 10-30 feet of the unconsolidated alluvial materials. At the site, the watertable is shallow and typically two to five feet below the existing grade, and in places the tailings are in groundwater.

The primary direction of groundwater flow in both the shallow and deeper groundwater systems is to the west and northwest. The principal recharge of the deeper groundwater system is through infiltration of precipitation and streamflow along the flank of the Wasatch Mountains. There is also an upward component of flow from the deeper to the shallow system due to the artesian pressure on the deeper system.

6.2 Under the no action alternative, the degradation of groundwater quality would continue to exist. This potential is limited to the hydrogeologic setting. Upward gradient and migration precludes the deep downward migration of leachate and contaminants. If this upward gradient flow which currently exists was reversed, then degradation of the deeper aquifer would occur through leaching and infiltration. Increased pumping and groundwater withdrawals could cause a migration reversal which could result in serious groundwater contamination.

Another potential exists for lateral migration of leachate and contaminants within the shallow groundwater system beneath the site. Leachate generation would continue, and metals, dissolved salts and radionuclides will exceed the EPA primary and secondary drinking water standards.

Under the on-site stabilization alternative, deep groundwater contamination is minimized, provided that increased deep groundwater withdrawals in the Vitro area do not revise the upward hydraulic gradient or significantly reduce the artesian pressure.

- 9.4 [Use of clay liners to preclude leachate migration has not been tested enough over materials of untested quality such as the Vitro tailings. The effectiveness of liners is suspect under conditions which exist at the Vitro site (see also page 11 comments).

Page 119, last paragraph

- 6.1 [Reports indicate that the groundwater within and under the tailings is contaminated. Reference is made to a two-three month groundwater study designed and implemented in February 1983 to produce data adequate to predict long-term groundwater movement and contamination. A six to eight week study cannot collect data reliable enough to predict present groundwater patterns, let alone hundreds of years into the future.

Page 124, 5.6 - Impact on Land Use

Alternative 2

- 13.1 [The DOE has apparently forgotten that as early as 1975 decisions were made to move the Vitro tailings and allow other use of the land. The draft EIS does not give adequate attention to the long-range land use planning done by Salt Lake County for the Vitro area. The draft EIS glosses over the long-range Master Plan by the CVWRF Board, although acknowledging that the Board must change its plans in mid-construction. It does not attempt to quantify the dollar magnitude of this change, if made. It may also be that such a change is not possible.

Page 130, 5.9 - Impacts on Populations and Employment

Alternative 2

- 10.2 [The draft EIS makes no attempt to analyze the forgone job opportunities by removing 69 acres of prime industrial property from use. An Economic Impact Report prepared by Utah's Division of Community Development indicates a potential for on-site employment of 465 persons initially and over 900 within 20 years should this land become useful by removal of the Vitro tailings.

Page 133, 5.11 - Impacts on Economic Structure

This section is too brief and poorly done. It has completely ignored economic issues vital to the appropriate assessment of economic impacts.

An economic study conducted by Utah's Division of Community Development reports:

According to the Utah Department of Health, health and safety risks will prohibit the economic development of all property adjacent to the on-site stabilization areas, thereby constraining economic development of surrounding properties. Therefore, potential benefits to be realized from site development must be defined as the costs that society will incur if on-site stabilization is adopted.

The sum of capital investment, public revenues and private sector income resulting from the economic development of the Vitro site will exceed \$697 million within 30 years if not constrained by on-site stabilization.

Total taxes, licenses, and user fees resulting from Vitro site development will exceed \$82.1 million within 30 years.

Total wages, land rents, and business profits resulting from Vitro site development will exceed \$178 million within 30 years.

- 10.2 Employment generated by site development will increase from 465 jobs initially to over 900 jobs within 20 years.

- 10.3 [The differential cost of stabilization and decontamination (\$38.5 million) will be recovered in public sector revenues alone within ten years; total decontamination costs (\$61.0 million) will be recovered within 18 years (Note: This estimate uses the DOE cost estimates. The state's own cost estimates certainly reduce the differential and allow for recovery within a much shorter timeframe.) The state's share of site decontamination costs (\$61.0 million) will be recovered in state income and sales taxes within 19 years. Local public revenues will exceed \$53.7 million within 30 years.

Page 136

- 9.6 [Sand gravel and clay are in sufficiently short supply along the Wasatch Front to be considered "significant resources."

- 9.1 [Page A-20 and A-21
Dam failure should be considered. If this factor is added to a probable maximum flood in progress, floodwater velocities could reach seven feet per second, thereby creating an erosion hazard.

Page A-35

The sensitivity of the clay types to be used, to various on-site factors, should be addressed.

- [The statement, "[i]f a liquefaction incident were to occur in one of the discontinuous soil layers little evidence of liquefaction would be apparent and damage to the site would not be expected.", is inaccurate.

Page 138, Alternative 2

..."By some revision of plans, the other uses proposed for the 126-acre tract could probably be accommodated;..."(emphasis added). It is extraordinarily expensive to change plans in mid-construction. This proposal would lead to construction delays, increased engineering costs and bid price changes.

Other uses for the tract could not be accommodated since the lands that are to be leased would not be available for that use. The NRC would have the land under control, seemingly forever.

Page 141

- 13.7 The Board of State Lands and Forestry has expressed its willingness to accommodate the DOE on whichever option (lease, sale or exchange) the DOE chooses to pursue regarding the South Clive site. Since the NRC will ultimately assume ownership of the property, it is the Board of State Lands and Forestry's preference that the entire section be exchanged and that the exchange be completed prior to any construction at the South Clive site.
- If an exchange cannot be completed before construction begins, a special use lease from the Division of State Lands and Forestry will be required. A right-of-way permit will also be required if access is needed across state land which is not included in the special use lease acreage.

Page A-10 - paragraph 1, 2, and Table A-3

- 2.4 A discussion of applicable EPA standards for remedial action at contaminated sites is given.
- Major portions of the final EPA standards are not addressed, nor is Congressional intent noted. The Uranium Mill Tailings Radiation Control Act reflects (in Section 206) Congressional desire that EPA's standards be consistent, to the maximum extent practicable, with the Solid Waste Disposal Act.
- Subpart C -- Implementation of the Final EPA Standard 192.20, requires "...[j]udgments on the possible need for remedial actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 CFR 32274, July 26, 1982) and by relevant state and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

Page A-14, A.4.1.3

- 6.3 "Two principal groundwater systems have been identified within the area of the Vitro site; a shallow water table system and a deeper partially-confined system (see Section 4.6.2). The water table in the upper, unconfined system ranges seasonally from about 2 to 5 feet below the existing ground surface and is locally above the base of the tailings throughout the year." This statement is misleading since it only represents a single season observation. Actually, watertable measurements taken during CVWRF design and construction (1980-1982) indicate a much broader groundwater surface fluctuation; elevations as low as 4223 have been reported on the CVWRF site in the vicinity of the existing secondary sedimentation tanks. Also, since the primary direction of groundwater flow is northwest (i.e., toward Mill Creek and the Jordan River), a strong potential exists for migration of any contaminant from the site to nearby surface waters if a total containment barrier is not provided.

Page A-33, paragraph 3

"In the analyses, consideration was given to the placement of a thin layer of the imported clay soils (Type 4) directly on top of the contaminated materials." The DOE has not identified the source of type 4 clay soils in Utah. Costs of importing from out of state could be prohibitive.

A-35 paragraph 2

- Site stability of the Vitro site is examined. Nowhere in the test is reference made to the problems associated with differential settlement of the proposed embankment.
- Tests have been conducted at the site by the construction management firm for the CVWRF Board. They have determined that there is considerable danger of differential settlement from the proposed stabilization loads. Their concerns are:
- 6.5 Estimated settlement at the CVWRF site from a stabilized load 29 feet high would be 15 inches maximum.
- Estimated settlement at the CVWRF site from a stabilized load 37 feet high would be 22 inches maximum.
- Settlement or consolidation might extend for a period of up to three years.
- The underlying soil has lenses of sand, silt, clay and various mixtures. Shear strengths vary widely, and their estimated settlement rates are based on empirical data from reload piles at the site.
- It is estimated that considerable damage to adjacent roadways (3300 South and 900 West), could occur from soil settlement if the tailings were piled and stabilized in place. This settlement could also damage utilities and other properties in the immediate area (within 150 feet). In addition, such differential settlement would jeopardize the integrity of any clay liner use for on-site stabilization.

Page A-40

- 9.1 The failure of a clay liner due to differential settlement was not discussed. How can the clay liner's integrity be assured under these conditions?

Appendix D - Hydrologic and Water Quality Information

- 6.1 Appendix D is incomplete, lacking data from the newly proposed and currently implemented groundwater study at the present Vitro site. Criteria specifying a limited time frame study (six to eight weeks) will provide questionable data for modeling future groundwater conditions at the Vitro site.

Appendix E - Socioeconomic Information

This appendix, as well as Section 5.11, "Impacts on Economic Structure," overlook many potential economic impacts of on-site stabilization. Consequently, Utah's Division of Community Development prepared a report, entitled Economic Impacts of Alternative Remedial Actions for the Vitro Tailings, that examines the economic concerns not covered in the draft EIS. A copy of this report is attached.

In prepared remarks by Governor Scott M. Matheson, (see attached) mention was made of the lack of a hazardous materials analysis of the Vitro uranium mill tailings. Because the tailings fail the EPA's EP toxicity test, the impacts to public health and to the environment caused by leachates from the tailings impoundment must be considered.

The Utah's Geologic and Mineral Survey has grave concerns about the seismic analysis included in the draft EIS. Their report, closely examining the seismic studies, is also included in Utah's written response to the draft EIS.

11.1 [Finally environmentally, economically and medically, for the generations of men, women and children, now and to come, on-site stabilization cannot be justified.

9.5 [The Congressional report accompanying P.L. 95-604 expressed the view that the methods used for remedial actions should not have short-lived effectiveness. The report states, "[t]he committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms...The Committee does not want to visit this problem again with additional aid. The remedial action must be done the first time."

20.1 [The state of Utah concurs with this reasoning. It does not want future generations to be faced with a Salt Lake City equivalent of the Love Canal or Times Beach environmental disasters because the job was not done right the first time. There will be no second chance. The only acceptable option for remedial action at the Vitro uranium mill tailings site is immediate relocation to a remote, environmentally acceptable location.

4.1 [There has been too much delay already. The relocation of these tailings must begin this year.

13.2 [In a position paper developed by the Department of Health in January 1983 (attached copy), the Vitro tailings are characterized as "a blight that will discourage development."

STATEMENT ON THE DEPARTMENT OF ENERGY
DRAFT ENVIRONMENTAL IMPACT STATEMENT

for

REMEDIAL ACTION AT THE FORMER
VITRO CHEMICAL COMPANY

Scott M. Matheson
Governor, State of Utah

Presented at Public Hearings
March 22, 1983, Tooele, Utah
March 23, 1983, South Salt Lake City, Utah

STATEMENT ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR
REMEDIAL ACTIONS AT THE FORMER VITRO CHEMICAL COMPANY SITE
SOUTH SALT LAKE, SALT LAKE COUNTY, UTAH

I am James O. Mason, Executive Director of the Utah Department of Health. Previous commitments prevent Governor Scott M. Matheson's attendance, but he has asked me to represent him at the public hearing today and to deliver the oral comments of the State of Utah on the Draft Environmental Impact Statement prepared by the Department of Energy. Governor Matheson is extremely concerned about the ultimate fate of the uranium mill tailings at the old Vitro site in the Salt Lake Valley and has consistently said that the tailings must be moved to an environmentally acceptable remote site.

These comments will give a broad overview of our concerns and differences with the DEIS. The State of Utah will submit formal written comments which will cover all the technical and other differences we have with the DEIS by April 11, 1983.

Over the past 25 years, Utah citizens and elected officials have expressed a growing concern with the location of the Vitro uranium mill tailings pile within the metropolitan area of the Salt Lake Valley.

The recognized health hazards associated with the tailings are gamma radiation, radon gas and its daughter products and those metals and chemical wastes left from the milling

process. The adverse biological effects of radiation exposure are well known. Gamma radiation and radon daughter products have been linked to cancer. The radiation hazard from tailings lasts for many thousands of years, and some non-radioactive toxic chemicals persist forever.

The hazard from uranium tailings pose an immediate threat to the environment and to men, women and children who live and work in the Salt Lake Valley. Beyond this clear and present danger, the tailings are vulnerable to human misuse and to dispersal by natural forces for thousands of years. This threat of expanded, indefinite contamination overshadows the present dangers to the public.

For the past quarter century, Utah's consistent policy has been that the tailings must be moved to a remote area. The following list is indicative of the broad-based support to remove the tailings to a remote area.

1. Former Governor Calvin Rampton
2. Governor Scott M. Matheson
3. Utah's Congressional Delegation
4. Utah State Legislature, 1979, S.B. 335
5. Utah Department of Health
6. South Salt Lake City, April 1982, Resolution
7. West Valley City, June 1982, Resolution
8. Salt Lake County, 1982, Resolution
9. Various civic and community groups

In fact, as late as June, 1981, even the U.S. Department of Energy (DOE) advocated tailings removal in a Remedial Action Concept Paper for the Vitro uranium mill tailings pile. I quote from page 15, "it appears that option 2B, Disposal at the First Alternative Area [a remote area] is the economically and environmentally preferable action." One year later in April, 1982, a draft of a second version of the Remedial Action Concept Paper was produced by DOE. On page 13, in an abrupt change of direction, this draft listed stabilization in-place as the preferred option, giving stabilization cost as the overriding issue. Last year was the first time any consideration other than health, safety, and technical aspects were even considered by DOE. Now, however, cost of stabilization has taken precedence over any other professional considerations.

Up until April, 1982, there was only the option of moving the tailings. Now, in March, 1983, DOE is asking us to review a Draft Environmental Impact Statement (DEIS) for Remedial Actions at the Vitro Site. This statement identifies two proposals for remedial action. The first alternative is stabilization in-place. I am sure the Vitro site would never have been purposefully considered as a siting option, because of its many geotechnical shortcomings, had not the tailings already been located there. If this alternative were to be exercised, the tailings would pose a continuing threat to the underlying aquifers.

Data in the DEIS suggest that the shallow aquifer is now contaminated and that as many as 120 wells located within a half-mile radius of the site may be drawing domestic water from that source. Our own research indicates that 41 wells are using the shallow aquifer for domestic purposes; however, Department of Health data do not presently show contamination of these wells. That potential for contamination will linger as long as the tailings remain on the Vitro site. It is just a matter of time before those wells no longer meet health standards.

The DEIS proposes a clay liner beneath the tailings in an attempt to reduce contamination to the underlying aquifers. Scientists at Utah's Geologic and Mineral Survey and Department of Health indicate the long-term integrity of a liner is seriously questioned for two reasons. First, the earthquake analysis reported in the DEIS is gravely inadequate, raising questions concerning liner stability during severe ground motions.

Secondly, the soil under the proposed stabilization areas has little structural integrity. Placement of large embankments at the Vitro site will lead to the ground settling at different rates and varying degrees unless the site is covered with an extremely large mound of earth for three years to assure uniform ground settling. This would tremendously increase costs to the project. (This has not been considered in the DEIS.) Without this precaution, uneven settling would breach the liner, damage roads and disrupt utilities.

As a matter of fact, the State requires more restrictive siting and design criteria for a sanitary landfill than the proposal does for stabilizing the Vitro tailings in-place.

The second option for remedial action at the Vitro tailings pile is to move them to a remote area. This proposed site is further away from any population site in Salt Lake or Tooele Counties than the current Vitro site in the middle of the Salt Lake Valley. The DEIS indicates that the geotechnical considerations that make stabilization in-place a poor choice in the Salt Lake Valley are not problems at the remote site. Ground water, earthquake, and population density are not problems at the remote site; in fact, not a single environmental issue has been identified at this location.

Why then are we examining two proposed options? This question must be asked after reading the DEIS. It is clearly pointed out in this document that relocation of the tailings to a remote area is the environmentally superior solution to the problem and that this relocation can be carried out safely and without great risk to our citizens. Every precaution will be taken to assure a safe transportation process.

The answer is money. DOE indicates there is a great disparity in cost of the two options. They value the cost of stabilization in-place at \$22,548,000, but admit this low figure does not include the costs of utility relocations, land aquisition, and other costs associated with ground water control. The Utah Department of Health and the Utah Department

of Transportation estimate a more accurate cost of stabilization in-place at \$43,315,000 or \$20,827,000 more than the DOE figures.

REMEDIAL ACTION COST ESTIMATES STABILIZATION IN-PLACE

	<u>UTAH</u>	<u>DOE</u>
Construction, Engineering and Inspection	\$25,415,000	\$22,548,000
Land Aquisition costs, utility relocation, and ground water control	\$17,960,000	not included
TOTAL	<u>\$43,375,000</u>	<u>\$22,548,000</u>
DIFFERENCE	<u>+20,827,000</u>	

RELOCATION TO A REMOTE SITE

	<u>UTAH</u>	<u>DOE</u>
Construction, Engineering and Inspection	\$53,222,000	\$61,014,000
TOTAL	53,222,000	\$61,014,000
DIFFERENCE	-\$7,792,000	
TOTAL COST DIFFERENCE BETWEEN ON-SITE STABILIZATION AND RE-LOCATION	<u>+\$9,847,000</u>	<u>+\$38,466,000</u>

DOE indicates that it will cost \$61,014,000 to relocate the Vitro tailings to a remote site. Our estimates indicate that at

current Utah construction costs, the relocation would cost \$53,222,000 or \$7,792,000 less than DOE figures. The actual cost differential between stabilization in Salt Lake Valley and a permanent solution in the remote western desert is likely to be less than \$10 million.

This cost difference could be realized through increased economic development in a few years after removal of the tailings. The Utah Department of Economic and Community Development conducted an economic study in March 1983 based on DOE figures. This critical issue is not addressed in the DEIS. Using DOE's own figures (which we now find to be inaccurate) this study notes among other things:

"The sum of capital investment, public revenues, and private sector income resulting from the economic development of the Vitro site will exceed \$697 million within thirty years if not constrained by on-site stabilization."

"Employment generated by site development will increase from 465 jobs initially to over 900 jobs within twenty years."

"The differential cost of stabilization and decontamination (\$38.5 million) will be recovered in public sector revenues alone within ten years; total decontamination costs (\$61 million) will be recovered within eighteen years."

Environmentally, economically, and for the health of men, women and children now and for generations to come, stabilization in-place cannot be justified.

The Congressional report accompanying Public Law 95-604, The Uranium Mill Tailings Remedial Action Act of 1978, expressed the

view that the methods used for remedial actions should not have short-lived effectiveness. It states, "The Committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms." It continues, "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."

I concur with that reasoning. I do not want future generations to be faced with a Salt Lake City Love Canal or Times Beach environmental disaster because we did not do the job right the first time. There will be no second chance. The only acceptable option for remedial action at the Vitro uranium mill tailings site is the immediate relocation to a remote, environmentally suitable location. There has been too much delay already. We must begin the relocation of these tailings this year.

EXECUTIVE SUMMARY

ECONOMIC IMPACTS OF ALTERNATIVE REMEDIAL

ACTIONS FOR THE VITRO TAILINGS

RECEIVED
DOCUMENT CONTROL

12 MAY 1983

March 21, 1983

Prepared by
Nile Eatmon
Division of Community Development

This report analyzes the economic opportunity costs that will be incurred by the public and private sectors of the State and local economies if on-site stabilization is adopted by DOE as the VITRO site remedial action. Data and analysis developed in this report may equally be considered to reflect the benefits that will accrue to the public and private sectors if site decontamination is undertaken. The analysis has been limited to economic considerations, and do not include health and safety risks, or costs resulting from these risks.

This study results in the following conclusions:

- o According to the Utah Department of Health, health and safety risks will prohibit the economic development of all property adjacent to the on-site stabilization area, thereby constraining economic development of surrounding properties. Therefore potential benefits to be realized from site development must be defined as the costs that society will incur if on-site stabilization is adopted.

- o The sum of capital investment, public revenues, and private sector income resulting from the economic development of the VITRO site will exceed \$697 million within thirty years if not constrained by on-site stabilization.

- o Total taxes, licenses, and user fees resulting from VITRO site development will exceed \$82.1 million within thirty years.

- o Total wages, land rents, and business profits resulting from VITRO site development will exceed \$178 million within thirty years.

- o Employment generated by site development will increase from 465 jobs initially to over 900 jobs within twenty years.

- o The differential cost of stabilization and decontamination (\$38.5 million) will be recovered in public sector revenues alone within ten years; total decontamination costs (\$61.0 million) will be recovered within eighteen years.

- o The State's share of site decontamination costs (\$6.1 million) will be recovered in State income and sales taxes within nineteen years.

- o Local public revenues will exceed \$53.7 million within thirty years.

I. OVERVIEW.

The VITRO site is a 128-acre property four miles south-southwest of the center of Salt Lake City, in South Salt Lake City. The entire site is owned by the Central Valley Water Reclamation Facility Board, which operates a sewage treatment plant on adjacent property north of the central portion of the VITRO site.

From 1951 to 1964 the Vitro Chemical Company of America processed uranium ore for sale to the U.S. Atomic Energy Commission at a mill in the southeast corner of the site. When the plant was dismantled in 1970, the radioactively contaminated materials from the processing operations (approximately 3 million tons) remained on the site.

The U.S. Department of Energy, in its draft environmental impact statement of February 1983, has identified three alternatives for remedial action on the VITRO site. These include the following:

1. No action. Does not meet EPA standards. Considered an unacceptable alternative.
2. Stabilization of contaminated materials on-site. Mitigates environmental and health hazards; EPA standards satisfied. Stabilization area (69 acres) not suitable for any other use; remainder of site capable of supporting economic development. Estimated cost: \$22.5 million.
3. Decontamination of VITRO site and disposal of contaminated material at South Clive site in Tooele County. Eliminates environmental and health hazards. Economic development of entire VITRO site feasible. Estimated cost: \$61.0 million.

DOE will become responsible for 90% of the costs of any remedial action, with the State of Utah incurring the remaining 10%.

Although no 'preferred alternative' has been specified in the Draft EIS, DOE's estimated costs of the proposed remedial alternatives imply that on-site stabilization (Alternative 2) would be the least costly and most environmentally acceptable action. Consequently, it may well be the eventual preferred action. DOE's assessment of the costs of on-site stabilization, however, can be subjected to two major criticisms:

1. As determined by the State Department of Health, on-site stabilization will not adequately protect the health and safety of Utah residents; accordingly,

2. Health and safety risks will prohibit the economic development of all properties adjacent to the "stabilization area" and constrain economic development of surrounding properties.

If a 'least-cost' criterion is employed by DOE in formulating its preferred remedial action, then the total costs of on-site stabilization should be accurately assessed. The omission of opportunity costs incurred as the result of unduly constrained economic growth of the site and surrounding properties, as well as those intangible, yet more catastrophic costs to the health and safety of local residents, raises serious concerns that DOE's implicitly preferred remedial action may not be the less costly alternative.

In this report, we investigate the public and private sector costs of adopting on-site stabilization as the VITRO remedial action. The proposition has been advanced throughout the VITRO debates, that the potential economic benefits of VITRO site development, apart from health and safety considerations, would serve to eliminate all but site decontamination (Alternative 3) as the most economically viable remedial alternative. The following analysis confirms this hypothesis.

11. ASSUMPTIONS EMPLOYED IN THE ANALYSIS.

Site description. The property in question is located in the incorporated area of South Salt Lake City and consists of a total of 128 acres.¹ We assume that 69 acres in the southern portion of the property will be developed to support commercial and industrial enterprises. This tract is presently zoned for business and industrial activities.² The remaining 59 acres will be available for any future expansion of the Central Valley sewer treatment facility.

Distribution type industrial parks and high technology oriented operations are predominant in the area. Established industrial parks enjoy prime tenants and a high rate of occupancy.³

Tract development. Commercial development of the 69 acre tract is assumed to occur in the following fashion:

1. Immediate developments:

- Industrial Park (20 acres);
- Resource Recovery Facility (15 acres).

2. Future developments:

- Remaining 34 acre tract developed over 20 year period;
1.7 acres developed annually.

The construction of an industrial park represents the best utility of the subject property and reflects the preferences of businesses for a planned development which places restrictions of the types of buildings and occupants.⁴ The Resource Recovery Facility has been in the advanced planning stages for several months and is included in the City of South Salt Lake's comprehensive masterplan.⁵ Development of the remaining 34 acres will occur over a twenty year period. This development schedule is consistent with the pace of commercial development occurring on similar tracts in the area.⁶

Land values. The Salt Lake County Assessor's Office has established the following market values for land within the 69 acre tract:⁷

1. Industrial Park: \$193,040 per acre;
Total land value: \$3,860,000.
2. Resource Recovery Facility: \$152,400 per acre;
Total land value: \$2,286,000
3. Remaining 34 acre tract: \$152,400 per acre;
Total land value: \$5,181,600.

Newly developed industrial parks, similar in location and desirability, form the basis of the Industrial Park's land value appraisal. Land values in the Decker Lake Industrial Park range from \$177,500 per acre to \$380,900 per acre.⁸ Yates Industrial Park and Pioneer Industrial Park have land values ranging from \$203,200 per acre to \$406,000 per acre.⁹ Land values outside industrial parks range from \$121,000 per acre to \$191,000 per acre.¹⁰ Building and structural values. Buildings and structures typically occupy sixty percent of each developed acre.¹¹ Construction costs are assumed to be \$32 per square feet, increasing two percent annually.¹² These figures were utilized to calculate the structural values within the industrial park and the 34 acre developable tract. Structural values of the Resource Recovery Facility were obtained from architectural specifications of the project.

4Assessed valuation. Assessed values of land and structures were assigned by using the 1978 roll-back formula of 19.69% of market value.¹³

Property taxes. Given assessed valuation, appropriate mill levies were employed to calculate property tax revenues. Mill levies in Salt Lake County and South Salt Lake City are presented below:¹⁴

Taxing Entity	Mill Levy
Salt Lake County:	
General Fund	17.42
Granite School District	45.25
Library Fund	3.35
Mosquito Abatement District	0.18
Water Conservancy District	2.00
Salt Lake City Water and Sewer District	4.16
Central Utah Water Conservancy District	2.00
Hansen Planetarium	0.20
Hogle Zoo	0.40
Total	74.96
South Salt Lake City	6.25

Retail sales and sales taxes. Retail sales, resulting from the establishment of retail sales businesses in the industrial park, are assumed to grow 6.5 percent annually from an initial sales total of \$4.5 million.¹⁵ Sales taxes accrue to the State of Utah at a 4 percent rate, and at a 0.75 percent rate to South Salt Lake City.¹⁶

Employment, earnings, and income taxes. An analysis of similar developments in the surrounding areas reveals that 6.7 employees are employed per average developed acre.¹⁷ Forty employees will serve the operational needs of the Resource Recovery Facility.¹⁸ Industrial Park, and Resource Recovery Facility employees, along with those individuals employed on the 34 acre tract, will generate an additional 1.6 jobs per direct employee within the local economy.¹⁹ (Construction employment was not included in this part of the analysis. The financial impact of these jobs were included within capital investment figures). An average annual salary of \$14,313 was applied to each employee.

State income taxes were generated by applying a 3 percent tax rate to gross wage income.²⁰ Federal individual income taxes were calculated utilizing a tax rate of 11 percent.²¹ An historical analysis of corporate earnings in the area reveals that annual corporate income is approximately 6 percent of annual gross wage income.²² Corporate income taxes were calculated utilizing a 48 percent tax rate.

Licenses and user fees. Annual business license fees are assumed to amount to \$8,250 initially, increasing \$500 annually due to new business establishments locating on the 69 acre tract.²³ Annual water sales revenues are assumed to be \$162,720 initially, increasing \$4,649 for each developed acre.²⁴ Annual sewer service fees are initially assumed to be \$113,364, increasing \$3,239 for each developed acre.²⁵

Discount rate. Gross public revenues are converted to present values through the application of a 6 percent discount rate. This rate has been chosen to reflect the long-run rate of return expected from both private and public investments.

III. THE OPPORTUNITY COSTS OF SITE STABILIZATION.

1. Public Sector Revenues.

Property tax revenues. Table 1 lists the gross property tax revenues that would accrue to Salt Lake County and South Salt Lake City if development of the site occurs as assumed. Annual property tax revenues in Salt Lake County range from \$2.7 million in the project's initial developmental stages to \$3.2 million after complete development of the 69 acre tract occurs. Annual revenues accruing to South Salt Lake City are \$226,000 initially, increasing to \$270,000 after twenty years. Total annual property tax revenues range from \$2.9 million initially to \$3.5 million after the 69 acre tract has been fully developed. Cumulative discounted revenues amount to \$46.7 million after thirty years. The cost differential between remedial alternatives is recovered in property tax revenues alone after approximately twenty years.

Sales tax revenues. The State of Utah will receive \$180,000 in annual sales tax revenues initially (Table 2). This figure will increase to \$519,000 after thirty years. South Salt Lake City will initially accrue \$34,000 in annual sales tax revenue. By year thirty, these receipts will increase to \$97,000 annually. Cumulative discounted revenues will grow from an initial figure of \$214,000 to \$5.2 million after thirty years.

Income tax revenues. Total annual state and federal income tax revenues will increase from \$1.1 million initially to \$2.2 million after twenty years (Table 3). Utah's share of these annual receipts will be nearly \$200,000 initially, increasing to \$393,000 after twenty years. Cumulative discounted revenues will increase from \$1.1 million initially, to over \$24 million after thirty years.

Licenses and user fees. Annual licenses from business licenses, water use fees, and sewer service fees (Table 4), will total \$284,000 initially, increasing to \$567,000 after thirty years. Cumulative discounted revenues reach \$6.1 million after thirty years.

Total public revenues. Table 5 lists the total public revenues that will accrue to local, state, and federal public entities throughout the development of the VITRO site. Gross public revenues increase from \$4.5 million annually to \$6.7 million after twenty years. Cumulative discounted revenues increase from \$4.5 million to \$82.1 million after thirty years. The cost differential between the remedial alternatives of stabilization and decontamination (\$38.5 million) is recovered in approximately ten years. Recovery of the total cost of site decontamination (\$61.0 million) occurs after eighteen years.

In Table 6, the local share of these total public revenues are delineated. Total local revenues increase from an annual figure of \$3.2 million to over \$4.1 million after thirty years. Cumulative discounted local revenues increase from \$3.2 million initially to over \$53.7 million after thirty years. In local public revenues alone, the cost differential between remedial alternatives (\$38.5 million) is recovered in approximately seventeen years. Table 7 lists the State revenues generated by the VITRO site development. Gross revenues accruing to the State of Utah increase from an initial figure of \$379,000 to over \$900,000 after thirty years. Cumulative discounted revenues reach \$8.7 million after thirty years. The State's share of the cost of site stabilization (\$2.25 million) is recovered in seven years. The State's share of site decontamination costs (\$6.1 million) is recovered in approximately 19 years.

In Table 8, the federal share of public revenues resulting from VITRO site development are analyzed. Annual revenues accruing to the federal government increase from \$923,000 initially, to over \$1.8 million after twenty years. Cumulative discounted federal revenues reach \$19.7 million after thirty years.

2. Private Sector Impacts.

Capital Investment. Capital investment expressed in the value of buildings and structures is presented in Table 9. Initial capital investments, since they include the value of the Resource Recovery Facility, are significantly large. Initial capital investments for the Resource Recovery Facility and within the proposed industrial park will amount to over \$172.9 million. This investment will generate approximately \$1.40 in additional economic activity for every \$1.00 expended. This multiplier effect will induce over \$242.1 million in additional economic activity, resulting in a \$415.1 million initial impact upon the local economy. Thereafter, annual investments will generate from \$3.5 million to \$5.1 million in economic activity. Cumulative discounted investment impacts will reach \$461.8 million after twenty years.

Employment and wage income. Table 10 lists the employment and wage income that will be generated by site development. For every individual employed during the operational phases at the developed site, an additional 1.6 jobs will be created. Total employment will grow from 465 employees to over 900 employees after twenty years. Gross wages earned by these employees will increase from \$6.6 million to \$13 million annually over the development period. Cumulative discounted gross earnings will reach \$142.6 million after thirty years.

Land rental values. Table 11 lists the cumulative discounted rental values that will accumulate to property owners. We assume in this analysis that annual rental values are 10 percent of land market values. Annual total rents for the 69 acre tract will remain at a constant \$1.8 million. Cumulative discounted rents will reach \$27.1 million after thirty years.

Business profits. In Table 12, we examine the behavior of business profits resulting from site development. Annual total profits before taxes (after tax profits are treated in Table 14) reach nearly \$400,000 initially, expanding to \$786,000 after twenty years. Cumulative discounted profits reach \$10 million after thirty years.

Total private sector income. Wages, land rents, and profits that will result from site development are analyzed in Table 13. Annual private sector earnings will be approximately \$8.9 million initially, increasing to

\$15.7 million annually after twenty years. Cumulative discounted earnings will expand to over \$178 million after thirty years. The total cost of site decontamination (\$61.0 million) is recovered in terms of private sector income after only eight years.

3. Total Public and Private Sector Impacts.

Total public and private sector impacts are listed in Table 14. Total public sector revenues increase from \$4.5 million to \$6.7 million annually after twenty years. After tax private sector earnings increase from \$7.8 million to \$13.5 million annually after twenty years. A twenty year development scenario induces over \$461.8 million in discounted investment activity. The cumulative discounted impacts reaching the public and private sectors reaches \$697.5 million after thirty years.

IV. CONCLUSIONS.

In this report, we have examined the benefits that would accrue to both the public and private sectors as a result of VITRO site development. It must be emphasized that these benefits may only accrue to these sectors if decontamination of the VITRO site is achieved. Health and safety risks will prohibit development of the site if stabilization is adopted as the remedial action. The benefits analyzed in this report can therefore be defined as the opportunity costs that the public and private sectors would incur if stabilization is adopted. The analysis in this report reveals significant and long term benefits to site decontamination. Site decontamination costs incurred by the State of Utah would be quickly recovered and would place little burden on the State's taxpayers. From a cost/benefit standpoint, site decontamination is the most economically advantageous remedial action.

Table 1
Property Tax Revenues

<u>Year</u>	<u>Number of Developed Acres</u>	<u>S.L. Co. Tax Revenues</u>	<u>So Salt Lake City Tax Revenues</u>	<u>Gross Revenues</u>	<u>Cumulative Discounted (6%) Revenues</u>
1	35.0	\$2,720,013	\$226,789	\$2,946,802	\$2,946,802
2	36.7	2,742,297	228,574	2,970,871	5,749,510
3	38.4	2,763,251	230,394	2,993,645	8,413,843
4	40.1	2,785,535	232,252	3,017,787	10,947,635
5	41.8	2,808,263	234,147	3,042,410	13,357,509
6	43.5	2,831,445	236,080	3,067,525	15,559,742
7	45.2	2,855,093	238,052	3,093,145	17,630,267
8	46.9	2,879,213	240,063	3,119,276	19,904,764
9	48.6	2,903,818	242,115	3,145,933	21,678,581
10	50.3	2,928,915	244,208	3,173,123	23,756,748
11	52.0	2,954,516	246,343	3,200,859	25,544,091
12	53.7	2,980,629	248,520	3,229,149	27,245,166
13	55.4	3,007,267	250,741	3,258,008	28,864,296
14	57.1	3,034,436	253,006	3,287,442	30,405,577
15	58.8	3,062,149	255,317	3,317,466	31,872,895
16	60.5	3,090,420	257,674	3,348,094	33,269,938
17	62.2	3,119,253	260,078	3,379,331	34,600,199
18	63.0	3,148,665	262,530	3,411,195	35,866,995
19	65.6	3,178,667	265,032	3,443,699	37,073,474
20	67.3	3,209,259	267,583	3,476,842	38,222,616
21	69.0	3,240,461	270,185	3,510,646	39,317,252
22	69.0	3,240,461	270,185	3,510,646	40,349,927
23	69.0	3,240,461	270,185	3,510,646	41,324,149
24	69.0	3,240,461	270,185	3,510,646	42,243,227
25	69.0	3,240,461	270,185	3,510,646	43,110,281
26	69.0	3,240,461	270,185	3,510,646	43,928,257
27	69.0	3,240,461	270,185	3,510,646	44,699,932
28	69.0	3,240,461	270,185	3,510,646	45,427,927
29	69.0	3,240,461	270,185	3,510,646	46,114,715
30	69.0	3,240,461	270,185	3,510,646	46,762,628

Table 2
Sales Tax Revenues

<u>Year</u>	<u>State of Utah</u>	<u>So Salt Lake City</u>	<u>Gross Revenues</u>	<u>Cum. Discounted Revenues</u>
1	\$180,000	\$33,750	\$213,750	\$ 213,750
2	191,700	35,944	227,644	426,508
3	203,400	38,138	241,538	643,476
4	215,100	40,332	255,432	857,942
5	226,800	42,726	269,326	1,071,273
6	238,500	44,720	281,026	1,356,759
7	250,200	46,914	296,914	1,566,072
8	261,900	49,108	311,008	1,772,910
9	273,600	51,302	324,902	1,976,758
10	285,300	53,496	338,796	2,177,291
11	297,000	55,690	352,690	2,374,231
12	308,700	57,884	364,584	2,566,289
13	320,400	60,078	380,478	2,755,375
14	332,100	62,272	394,372	2,940,272
15	343,800	64,466	408,266	3,120,848
16	355,500	66,660	422,160	3,297,601
17	367,200	68,854	436,054	3,468,652
18	378,900	71,048	449,948	3,635,747
19	390,600	73,242	463,842	3,798,251
20	402,300	75,436	477,736	3,956,149
21	414,000	77,630	491,630	4,109,442
22	425,700	79,824	505,524	4,258,145
23	437,400	82,018	519,418	4,402,286
24	449,100	84,212	533,312	4,541,906
25	460,800	86,406	547,206	4,677,054
26	472,500	88,600	561,100	4,807,790
27	484,200	90,794	574,994	4,934,179
28	495,900	92,988	588,888	5,056,250
29	507,600	95,182	602,782	5,174,218
30	519,300	97,376	616,676	5,288,030

Table 4

Licenses and User Fees

Table 3
Income Tax Revenues

<u>Year</u> <u>Revenues</u>	<u>Number of</u> <u>Developed</u> <u>Areas</u>	<u>State of</u> <u>Utah</u>	<u>Federal Taxes</u> <u>Individual</u>	<u>Corporate</u>	<u>Gross</u> <u>Revenues</u>	<u>Cumulative</u> <u>Discounted</u>	<u>Year</u>	<u>No of</u> <u>Develop</u> <u>Acres</u>	<u>Business</u> <u>Licenses</u>	<u>Water</u> <u>User</u> <u>Fees</u>	<u>Sewer</u> <u>Service</u> <u>Fees</u>	<u>Gross</u> <u>Revenues</u>	<u>Cumulative</u> <u>Discounted</u> <u>Revenues</u>
1	35.0	\$199,505	\$731,520	\$191,525	\$1,122,550	\$1,122,550	1	35.0	\$ 8,250	\$162,720	\$113,364	\$284,334	\$ 284,334
2	36.7	209,196	767,050	200,828	1,177,074	2,232,957	2	36.7	8,750	170,623	118,870	298,243	565,695
3	38.4	218,886	802,581	210,130	1,231,597	3,329,114	3	38.4	9,250	178,526	124,376	312,152	843,509
4	40.1	228,576	838,112	219,433	1,286,121	4,408,966	4	40.1	9,750	186,429	129,882	326,061	1,117,276
5	41.8	238,266	873,643	228,736	1,339,947	5,470,330	5	41.8	10,250	194,332	135,388	339,970	1,386,654
6	43.5	247,957	909,174	238,038	1,395,169	6,512,881	6	43.5	10,750	202,235	140,894	353,879	1,651,003
7	45.2	257,647	944,705	247,341	1,449,693	7,534,857	7	45.2	11,250	210,138	146,400	367,788	1,910,279
8	46.9	267,337	980,236	256,644	1,504,217	8,535,247	8	46.9	11,750	218,041	151,906	381,697	2,164,129
9	48.6	277,027	1,015,767	265,946	1,558,740	9,513,220	9	48.6	12,250	225,944	157,412	395,606	2,412,337
10	50.3	286,718	1,051,298	275,249	1,613,265	10,468,109	10	50.3	12,750	233,847	162,918	409,515	2,654,728
11	52.0	296,408	1,086,829	284,552	1,667,789	11,399,394	11	52.0	13,250	241,750	168,424	423,424	2,891,166
12	53.7	306,098	1,122,360	293,854	1,722,312	12,306,666	12	53.7	13,750	249,653	173,930	437,333	3,121,548
13	55.4	315,788	1,157,891	303,157	1,776,836	13,189,719	13	55.4	14,250	257,556	179,436	451,242	3,345,801
14	57.1	325,479	1,193,422	312,460	1,831,361	14,048,333	14	57.1	14,750	265,459	184,942	465,151	3,563,882
15	58.8	335,169	1,228,953	321,762	1,905,884	14,891,307	15	58.8	15,250	273,362	190,448	479,060	3,775,771
16	60.5	344,859	1,264,483	331,065	1,940,407	15,700,971	16	60.5	15,750	281,265	195,954	492,969	3,981,470
17	62.2	354,549	1,300,015	340,367	1,994,931	16,486,268	17	62.2	16,250	289,168	201,460	506,878	4,181,001
18	63.9	364,240	1,335,546	349,670	2,049,456	17,247,363	18	63.9	16,750	297,071	206,966	520,787	4,374,403
19	65.6	373,930	1,371,077	358,973	2,103,980	17,984,479	19	65.6	17,250	304,974	212,472	534,696	4,561,730
20	67.3	383,620	1,406,608	368,973	2,159,201	18,698,123	20	67.3	17,750	312,877	217,978	548,605	4,743,051
21	69.0	393,311	1,442,138	377,578	2,213,027	19,385,155	21	69.0	18,250	320,780	223,484	562,514	4,918,446
22	69.0	393,311	1,442,138	377,578	2,213,027	20,039,129	22	69.0	18,750	320,780	223,484	563,014	5,084,060
23	69.0	393,311	1,442,138	377,578	2,213,027	20,653,255	23	69.0	19,250	320,780	223,484	563,514	5,240,438
24	69.0	393,311	1,442,138	377,578	2,213,027	21,232,619	24	69.0	19,750	320,780	223,484	564,014	5,388,015
25	69.0	393,311	1,442,138	377,578	2,213,027	21,779,189	25	69.0	20,250	320,780	223,484	564,514	5,527,510
26	69.0	393,311	1,442,138	377,578	2,213,027	22,294,821	26	69.0	20,750	320,780	223,484	565,014	5,659,165
27	69.0	393,311	1,442,138	377,578	2,213,027	22,781,267	27	69.0	21,250	320,780	223,484	565,514	5,783,471
28	69.0	393,311	1,442,138	377,578	2,213,027	23,240,178	28	69.0	21,750	320,780	223,484	566,014	5,900,844
29	69.0	393,311	1,442,138	377,578	2,213,027	23,673,113	29	69.0	22,250	320,780	223,484	566,514	6,011,671
30	69.0	393,311	1,442,138	377,578	2,213,027	24,081,542	30	69.0	22,750	320,780	223,484	567,014	6,116,317

210

Table 5
Total Public Revenues

Year	Number of Developed Acres	Property Taxes	Sales Taxes	Income Taxes	Licences User Fees	Gross Public Revenues	Cumulative Discounted Revenues
1	35.0	\$2,946,802	\$213,750	\$1,122,550	\$284,334	\$4,567,436	\$4,567,436
2	36.7	2,970,871	227,644	1,177,074	298,243	4,673,632	8,976,711
3	38.4	2,993,645	241,538	1,231,597	312,152	4,778,932	13,229,943
4	40.1	3,017,782	255,432	1,286,121	326,061	4,885,401	17,331,820
5	41.8	3,042,410	269,326	1,339,947	339,970	4,992,351	21,286,230
6	43.5	3,067,525	281,026	1,395,169	353,879	5,105,299	25,101,206
7	45.2	3,093,145	296,914	1,449,693	367,788	5,207,740	28,772,457
8	46.9	3,119,276	311,008	1,504,217	381,697	5,316,198	32,308,032
9	48.6	3,145,933	324,902	1,558,740	395,606	5,425,181	35,711,858
10	50.3	3,173,123	338,796	1,613,265	409,515	5,534,699	38,987,838
11	52.0	3,200,859	352,690	1,667,789	423,424	5,644,762	42,139,844
12	53.7	3,229,149	364,584	1,722,312	437,333	5,755,378	45,171,705
13	55.4	3,258,008	380,478	1,776,836	451,242	5,866,564	48,087,208
14	57.1	3,287,442	394,372	1,831,361	465,151	5,978,326	50,890,081
15	58.8	3,317,466	408,266	1,905,884	479,060	6,090,676	53,583,193
16	60.5	3,348,094	422,160	1,940,407	492,969	6,203,630	56,171,751
17	62.2	3,379,331	436,054	1,994,931	506,878	6,317,194	58,658,491
18	63.9	3,411,195	449,948	2,049,456	520,787	6,431,386	61,046,879
19	65.6	3,443,699	463,842	2,103,980	534,696	6,546,217	63,340,305
20	67.3	3,476,842	477,736	2,159,201	548,605	6,661,086	65,542,079
21	69.0	3,510,646	491,630	2,213,027	562,514	6,777,818	67,655,435
22	69.0	3,510,646	505,524	2,213,027	562,514	6,777,818	69,653,245
23	69.0	3,510,646	519,418	2,213,027	562,514	6,777,818	71,541,844
24	69.0	3,510,646	533,312	2,213,027	562,514	6,777,818	73,327,170
25	69.0	3,510,646	547,206	2,213,027	562,514	6,777,818	75,014,872
26	69.0	3,510,646	561,100	2,213,027	562,514	6,777,818	76,610,261
27	69.0	3,510,646	574,994	2,213,027	562,514	6,777,818	78,118,436
28	69.0	3,510,646	588,888	2,213,027	562,514	6,777,818	79,544,108
29	69.0	3,510,646	602,782	2,213,027	562,514	6,777,818	80,891,796
30	69.0	3,510,646	616,676	2,213,027	562,514	6,777,818	82,165,768

Table 6
Local Revenues

Year	No of Develop Acres	Property Taxes	So Sl Sales Taxes	Licenses & User Fees	Total Local Revenues	Cumulative Discounted Revenues
1	35.0	\$2,946,802	\$33,750	\$284,334	\$3,264,886	\$3,264,886
2	36.7	2,970,871	35,944	298,243	3,305,508	6,382,865
3	38.4	2,993,645	38,138	312,152	3,343,935	9,358,555
4	40.1	3,017,782	40,332	326,061	3,384,175	12,200,633
5	41.8	3,042,410	42,556	339,970	3,424,936	14,913,485
6	43.5	3,067,525	44,720	353,879	3,466,124	17,507,689
7	45.2	3,093,145	46,914	367,788	3,507,847	19,980,583
8	46.9	3,119,276	49,108	381,697	3,550,081	22,342,589
9	48.6	3,145,933	51,302	395,606	3,592,841	24,595,782
10	50.3	3,173,123	53,496	409,515	3,636,134	26,748,004
11	52.0	3,200,859	55,690	423,424	3,679,973	28,802,882
12	53.7	3,229,149	57,884	437,333	3,724,366	30,764,931
13	55.4	3,258,008	60,078	451,242	3,769,328	32,651,353
14	57.1	3,287,442	62,272	465,151	3,814,865	34,440,911
15	58.8	3,317,466	64,466	479,060	3,860,992	36,146,831
16	60.5	3,348,094	66,660	492,969	3,906,723	37,777,388
17	62.2	3,379,331	68,854	506,878	3,955,063	39,334,284
18	63.9	3,411,195	71,048	520,787	4,003,030	40,856,291
19	65.6	3,443,699	73,242	534,696	4,051,637	42,275,757
20	67.3	3,476,842	75,436	548,605	4,100,893	43,595,955
21	69.0	3,510,646	77,630	562,514	4,150,790	45,141,915
22	69.0	3,510,646	79,824	563,014	4,153,484	46,111,805
23	69.0	3,510,646	82,018	563,514	4,153,964	47,264,896
24	69.0	3,510,646	84,212	564,014	4,154,481	48,353,284
25	69.0	3,510,646	86,406	564,514	4,154,981	49,380,603
26	69.0	3,510,646	88,600	565,014	4,155,481	50,350,292
27	69.0	3,510,646	90,794	565,514	4,166,954	51,335,571
28	69.0	3,510,646	92,988	566,014	4,169,646	52,129,497
29	69.0	3,510,646	95,182	566,514	4,172,342	52,944,950
30	69.0	3,510,646	97,376	567,014	4,175,036	53,714,650

Table 7
State Tax Revenues

<u>Year</u>	<u>Income Taxes</u>	<u>Sales Taxes</u>	<u>Gross Revenues</u>	<u>Cum Discontd Revenues</u>
1	\$199,505	\$180,000	\$379,505	\$ 379,505
2	209,196	191,700	400,896	757,705
3	218,886	203,400	422,286	1,133,542
4	228,576	215,100	443,366	1,505,801
5	238,266	226,800	465,066	1,874,177
6	247,957	238,500	486,457	2,237,666
7	257,647	250,200	507,847	2,595,698
8	267,337	261,900	529,237	2,947,671
9	227,027	273,600	550,627	3,293,141
10	286,718	285,300	572,018	3,631,718
11	296,408	297,000	593,408	3,963,074
12	306,098	308,700	614,798	4,286,942
13	315,788	320,400	636,188	4,603,108
14	325,479	332,100	657,579	4,911,407
15	335,169	343,600	678,969	5,211,716
16	344,859	355,500	700,359	5,503,951
17	354,549	367,200	721,749	5,788,065
18	364,240	378,900	743,140	6,064,041
19	373,930	390,600	764,530	6,331,883
20	383,620	402,300	785,920	6,591,646
21	393,311	414,000	807,311	6,843,369
22	393,311	425,700	819,011	7,084,266
23	393,311	437,400	830,711	7,314,813
24	393,311	449,100	842,411	7,535,354
25	393,311	460,800	854,111	7,746,301
26	393,311	472,500	865,811	7,948,034
27	393,311	484,200	877,511	8,140,920
28	393,311	495,900	889,211	8,325,314
29	393,311	507,600	900,911	8,501,559
30	393,311	519,300	912,611	8,669,983

Table 8
Federal Tax Revenues

<u>Year</u>	<u>Number of Developed Acres</u>	<u>Indv. Income Taxes</u>	<u>Corporated Income Taxes</u>	<u>Total Federal Revenues</u>	<u>Cumulative Discounted (6%) Revenues</u>
1	35.0	\$ 731,520	\$191,525	\$ 923,045	\$ 923,045
2	36.7	767,050	200,828	967,878	1,836,137
3	38.4	802,581	210,130	1,012,711	2,737,446
4	40.1	838,112	219,433	1,057,545	3,625,381
5	41.8	873,643	228,736	1,102,379	4,498,568
6	43.5	909,174	238,038	1,147,212	5,355,831
7	45.2	944,705	247,341	1,192,046	6,156,176
8	46.9	980,236	256,644	1,236,880	7,018,772
9	48.6	1,015,767	265,946	1,281,713	7,822,935
10	50.3	1,051,298	275,249	1,326,547	8,608,116
11	52.0	1,086,829	284,552	1,371,381	9,373,888
12	53.7	1,122,360	293,854	1,416,214	10,119,932
13	55.4	1,157,891	303,157	1,461,048	10,832,747
14	57.1	1,193,422	312,460	1,505,882	11,538,763
15	58.8	1,228,953	321,762	1,550,715	12,224,646
16	60.5	1,264,483	331,065	1,595,548	12,890,412
17	62.2	1,300,015	340,367	1,640,382	13,536,142
18	63.9	1,335,546	349,670	1,685,216	14,126,547
19	65.6	1,371,077	358,973	1,730,050	14,732,659
20	67.3	1,406,608	368,275	1,774,883	15,354,478
21	69.0	1,442,139	377,578	1,819,717	15,921,874
22	69.0	1,442,139	377,578	1,819,717	16,457,154
23	69.0	1,442,139	377,578	1,819,717	16,962,135
24	69.0	1,442,139	377,578	1,819,717	17,438,532
25	69.0	1,442,139	377,578	1,819,717	17,887,963
26	69.0	1,442,139	377,578	1,819,717	18,311,955
27	69.0	1,442,139	377,578	1,819,717	18,771,947
28	69.0	1,442,139	377,578	1,819,717	19,069,297
29	69.0	1,442,139	377,578	1,819,717	19,445,289
30	69.0	1,442,139	377,578	1,819,717	19,781,130

Table 9
Capital Investment

Year	Number of Developed Acres	Capital Invest.	Additional Econ Activ Generated	Gross Invest Impact	Cumulative Discont Econ Impact
1	35.0	\$172,959,040	\$242,142,656	\$415,101,696	\$415,101,696
2	36.7	1,450,234	2,030,328	3,480,562	418,385,245
3	38.4	2,072,751	3,549,859	3,549,859	421,444,607
4	40.1	1,508,877	2,112,427	3,621,304	424,485,124
5	41.8	1,539,090	2,154,726	3,693,816	427,410,972
6	43.5	1,569,747	2,197,646	3,767,393	430,226,187
7	45.2	1,601,293	2,241,811	3,843,104	432,935,423
8	46.9	1,633,284	2,286,597	3,919,881	435,542,368
9	48.6	1,666,163	2,332,628	3,996,791	438,051,259
10	50.3	1,699,486	2,379,280	4,078,766	440,465,474
11	52.0	1,733,253	2,426,555	4,159,808	442,788,259
12	53.7	1,767,909	2,475,073	4,242,982	445,023,439
13	55.4	1,803,454	2,524,836	4,328,290	447,174,467
14	57.1	1,839,443	2,575,221	4,414,664	449,244,234
15	58.8	1,876,321	2,626,850	4,503,171	451,235,991
16	60.5	1,913,643	2,679,100	4,592,743	453,152,382
17	62.2	1,915,854	2,732,595	4,684,449	455,107,039
18	63.9	1,990,953	2,787,334	4,778,287	456,881,525
19	65.6	2,030,941	2,843,317	4,874,258	458,589,191
20	67.3	2,071,818	2,900,345	4,972,363	460,232,622
21	69.0	2,113,138	2,956,394	5,071,532	461,613,950

Table 10
Employment and Wage Income

Year	No of Develop Acres	Direct Employees	Indirect Employees	Total Employees	Total Wage Income	Cumulative Discont Wage Income
1	35.0	174	291	465	\$6,655,545	\$6,655,545
2	36.7	185	304	487	6,970,431	13,231,423
3	38.4	191	319	510	7,299,630	19,728,068
4	40.1	200	332	532	7,614,516	26,121,362
5	41.8	208	347	555	7,943,715	32,413,528
6	43.5	217	360	577	8,258,601	38,584,835
7	45.2	225	375	600	8,587,800	44,638,895
8	46.9	233	389	622	8,902,688	50,559,690
9	48.6	242	403	645	9,231,885	56,351,689
10	50.3	250	418	668	9,561,084	62,011,080
11	52.0	259	431	690	9,675,970	67,525,770
12	53.7	267	446	713	10,205,169	72,901,726
13	55.4	276	459	735	10,520,055	78,129,871
14	57.1	284	474	758	10,849,254	83,216,425
15	58.8	293	488	781	11,178,453	88,160,666
16	60.5	301	502	803	11,493,339	92,956,435
17	62.2	310	516	826	11,822,538	97,610,330
18	63.9	318	530	848	12,137,424	102,117,737
19	65.6	327	544	871	12,466,623	104,485,341
20	67.3	335	558	893	12,781,509	110,709,796
21	69.0	343	573	916	13,110,708	114,797,777
22	69.0	343	573	916	13,110,708	118,654,363
23	69.0	343	573	916	13,110,708	122,292,651
24	69.0	343	573	916	13,110,708	125,724,998
25	69.0	343	573	916	13,110,708	128,963,062
26	69.0	343	573	916	13,110,708	132,017,839
27	69.0	343	573	916	13,110,708	134,899,704
28	69.0	343	573	916	13,110,708	137,618,445
29	69.0	343	573	916	13,110,708	140,183,374
30	69.0	343	573	916	13,110,708	142,602,374

Table 11
Land Rental Values

<u>Year</u>	<u>Total Rents</u>	<u>Cumulative Discounted Rents</u>
1	\$1,862,440	\$ 1,862,440
2	1,862,440	3,619,458
3	1,862,440	5,277,024
4	1,862,440	6,840,764
5	1,862,440	8,315,991
6	1,862,440	9,707,715
7	1,862,440	11,020,662
8	1,862,440	12,259,290
9	1,862,440	13,427,808
10	1,862,440	14,530,184
11	1,862,440	15,570,161
12	1,862,440	16,551,271
13	1,862,440	17,476,846
14	1,862,440	18,350,031
15	1,862,440	19,173,790
16	1,862,440	19,950,921
17	1,862,440	20,684,064
18	1,862,440	21,375,708
19	1,862,440	22,028,202
20	1,862,440	22,643,781
21	1,862,440	23,224,499
22	1,862,440	23,772,346
23	1,862,440	24,289,182
24	1,862,440	24,776,764
25	1,862,440	25,236,747
26	1,862,440	25,670,693
27	1,862,440	26,080,075
28	1,862,440	26,466,266
29	1,862,440	26,830,636
30	1,862,440	27,174,361

Table 12
Business Profits

<u>Year</u>	<u>No. of Developed Acres</u>	<u>Total Profits</u>	<u>Cumulative Discounted Profits</u>
1	35.0	\$399,010	\$ 399,010
2	36.7	418,392	793,719
3	38.4	437,771	1,183,334
4	40.1	457,152	1,567,167
5	41.8	476,533	1,944,626
6	43.5	495,913	2,315,201
7	45.2	515,294	2,678,463
8	46.9	534,675	3,034,052
9	48.6	554,054	3,381,673
10	50.3	573,435	3,721,088
11	52.0	592,817	4,071,975
12	53.7	612,196	4,394,473
13	55.4	631,577	4,708,347
14	57.1	650,958	5,031,853
15	58.8	670,338	5,328,344
16	60.5	689,719	5,616,140
17	62.2	709,098	5,895,274
18	63.9	728,479	6,165,805
19	65.6	747,860	6,427,613
20	67.3	767,240	6,681,413
21	69.0	786,621	6,926,996
22	69.0	786,621	7,195,262
23	69.0	786,621	7,481,553
24	69.0	786,621	7,773,076
25	69.0	786,621	8,069,697
26	69.0	786,621	8,371,318
27	69.0	786,621	8,677,939
28	69.0	786,621	8,989,560
29	69.0	786,621	9,306,181
30	69.0	786,621	9,632,802

Table 13
Total Private Sector Incomes

Year	Number of Developed Acres	Gross Wages	Total Rents	Total Profits Before Taxes	Gross Private Sector Income	Cumulative Discounted Income
1	35.0	\$6,655,545	\$1,812,440	\$399,010	\$8,916,995	\$8,916,995
2	36.7	6,970,431	1,812,440	418,392	9,251,263	17,644,602
3	38.4	7,299,630	1,812,440	437,771	9,599,841	26,188,426
4	40.1	7,614,516	1,812,440	457,152	9,934,108	34,529,295
5	41.8	7,943,715	1,812,440	476,533	10,282,688	42,674,147
6	43.5	8,258,601	1,812,440	495,913	10,616,954	50,357,969
7	45.2	8,587,800	1,812,440	515,294	10,965,534	58,088,238
8	46.9	8,901,686	1,812,440	534,675	11,299,801	65,603,251
9	48.6	9,231,885	1,812,440	554,054	11,648,379	72,911,588
10	50.3	9,561,084	1,812,440	573,435	11,996,959	80,012,570
11	52.0	9,875,970	1,812,440	592,817	12,331,227	86,898,262
12	53.7	10,205,169	1,812,440	612,196	12,679,805	93,577,826
13	55.4	10,520,055	1,812,440	631,577	13,014,072	100,045,421
14	57.1	10,849,254	1,812,440	650,958	13,362,652	106,310,353
15	58.8	11,178,453	1,812,440	670,338	13,711,231	112,374,844
16	60.5	11,493,339	1,812,440	689,719	14,045,498	118,235,540
17	62.2	11,822,538	1,812,440	709,098	14,394,076	123,901,714
18	63.9	12,137,414	1,812,440	728,479	14,728,343	129,371,297
19	65.6	12,466,623	1,812,440	747,860	15,076,923	134,653,403
20	67.3	12,781,509	1,812,440	767,240	15,411,189	139,747,002
21	69.0	13,110,708	1,812,440	786,621	15,759,769	144,660,972
22	69.0	13,110,708	1,812,440	786,621	15,759,769	149,296,793
23	69.0	13,110,708	1,812,440	786,621	15,759,769	153,670,209
24	69.0	13,110,708	1,812,440	786,621	15,759,769	147,796,074
25	69.0	13,110,708	1,812,440	786,621	15,759,769	161,688,399
26	69.0	13,110,708	1,812,440	786,621	15,759,769	165,360,403
27	69.0	13,110,708	1,812,440	786,621	15,759,769	168,824,559
28	69.0	13,110,708	1,812,440	786,621	15,759,769	172,092,630
29	69.0	13,110,708	1,812,440	786,621	15,759,769	175,175,715
30	69.0	13,110,708	1,812,440	786,621	15,759,769	178,084,287

Table 14
Total Public and Private Sector Impacts

Year	Number of Developed Acres	Total Public Sector Revenues	After Tax Private Sector Income	Total Capital Investment	Total Impact	Cumulative Discounted Impact
1	35.0	\$4,567,436	\$7,794,445	\$415,101,696	\$427,463,577	\$427,463,577
2	36.7	4,673,832	8,074,189	3,480,562	16,228,583	442,773,561
3	38.4	4,778,932	8,368,244	3,549,859	16,697,035	457,633,863
4	40.1	4,885,401	8,647,987	3,621,304	17,154,692	472,037,273
5	41.8	4,992,351	8,942,741	3,693,816	17,628,909	486,001,020
6	43.5	5,105,299	9,221,785	3,767,393	18,094,477	499,522,264
7	45.2	5,207,740	9,515,841	3,843,104	18,566,685	512,611,044
8	46.9	5,316,198	9,795,584	3,919,881	19,031,663	525,268,187
9	48.6	5,425,181	10,089,639	3,998,791	19,513,611	537,511,268
10	50.3	5,434,699	10,383,694	4,078,766	19,997,159	549,347,555
11	52.0	5,644,762	10,663,438	4,159,808	20,468,008	560,776,784
12	53.7	5,755,378	10,957,493	4,242,982	20,955,853	571,816,066
13	55.4	5,866,564	11,237,236	4,328,290	21,432,092	582,230,483
14	57.1	5,978,326	11,531,291	4,414,664	21,924,281	592,509,442
15	58.8	6,090,676	11,805,347	4,503,171	21,849,758	602,206,572
16	60.5	6,203,630	12,105,091	4,592,743	22,901,464	611,762,553
17	62.2	6,317,194	12,399,145	4,684,449	23,400,787	620,974,186
18	63.9	6,431,386	12,678,887	4,778,287	23,888,560	629,664,405
19	65.6	6,546,217	12,972,943	4,874,258	24,393,416	638,210,468
20	67.3	6,661,686	13,251,988	4,972,363	24,886,037	646,435,647
21	69.0	6,777,818	13,546,742	5,071,532	25,396,092	654,354,266
22	69.0	6,777,818	13,546,742	5,071,532	20,324,560	660,332,848
23	69.0	6,777,818	13,546,742	5,071,532	20,324,560	665,973,017
24	69.0	6,777,818	13,546,742	5,071,532	20,324,560	671,293,931
25	69.0	6,777,818	13,546,742	5,071,532	20,324,560	676,313,661
26	69.0	6,777,818	13,546,742	5,071,532	20,324,560	681,049,256
27	69.0	6,777,818	13,546,742	5,071,532	20,324,560	685,516,793
28	69.0	6,777,818	13,546,742	5,071,532	20,324,560	689,731,460
29	69.0	6,777,818	13,546,742	5,071,532	20,324,560	693,707,557
30	69.0	6,777,818	13,546,742	5,071,532	20,324,560	697,458,591

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Scott M. Matheson
Governor



James O. Mason, M.D., Dr.P.H.
Executive Director
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STATE OF UTAH
DEPARTMENT OF HEALTH

150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110-2500

211

211

January 19, 1983

Honorable Scott M. Matheson
Governor of Utah
State Capitol
Salt Lake City, Utah 84114

Dear Governor Matheson:

Attached is the Department's position paper on remedial action for the Vitro uranium mill tailings.

Highlighted in the document is the importance of moving the tailings to a remote site away from Utah's major population centers. Although stabilization at its present urban location will prevent some hazards, this approach only addresses a part of the problem.

Long-term protection of the environment and mitigation of a serious urban blight can best be accomplished by removal of the tailings.

Sincerely,

James O. Mason, M.D., Dr.P.H.
Executive Director

Attachment

Vitro Uranium Mill Tailings
Remedial Action
Position Paper

UTAH DEPARTMENT OF HEALTH
January 17, 1983

James D. Mason, M.D., Dr.P.H.
Executive Director
Utah Department of Health

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DEPARTMENT OF HEALTH
Position Paper for the Vitro Uranium Mill Tailings
January 17, 1983

INDEX

- 1.0 Background Vitro Corporation of America, Salt Lake City Plant
 - 1.1. Early Western Uranium Mills
 - 1.2. Vanadium Processing During 1964 - 1968
 - 1.3. Shutdown - 1968
- 2.0 Radioactive Tailings from Vitro's Mill Operation
 - 2.1. Acid Leach/Solvent Extraction Method
 - 2.2. Tailings from Vitro's Mill Operation
 - 2.3. Radioactive Materials in Tailings
 - 2.4. Volume of Tailings and Contaminated Soils
 - 2.5. AEC Approved Use of Vitro Tailings for Construction
 - 2.6. Potential for Economic Reprocessing
- 3.0 Health Hazards from the Tailings Pile
 - 3.1. Radiation Health Hazards
 - 3.2. Gamma Radiation
 - 3.3. Radon Gas
 - 3.4. Radon Equilibrium - A Function of Air Movement
 - 3.5. EPA Requirements
 - 3.6. Engineering Radiation Control
- 4.0 Solutions for the Vitro Tailings Problems
 - 4.1. A Permanent Solution is Needed
 - 4.2. Vicinity Property Cleanup Begins 1981
 - 4.3. Federal Recommendations for Long Term Maintenance of the Vitro Tailings

-2-

- 4.4. Utah's Position on Vitro Remedial Actions
- 4.5. Local Government and Organization Support for Tailings Relocation
- 5.0 Federal Participation Needed
 - 5.1. Benefits vs. Risks
 - 5.2. Cost Estimates
 - 5.3. Life Cycle Costing Study
- 6.0 Conclusions and Position
 - 6.1. Conclusions
 - 6.2. Position

January 17, 1983

Executive Summary

The Vitro plant processed uranium ores by acid leach/solvent extraction from 1951 to 1964. During this period, the plant processed 1.7 million dry tons of ore. In 1965, the mill was converted to the production of vanadium. Vanadium production ceased in 1968.

The tailings are made up of extremely fine sands, clays, and slimes. Quantities of tailings, contaminated materials, and miscellaneous debris are listed in this paper. Mention is made of Atomic Energy Commission permission to use tailings for construction purposes.

The recognized health hazards associated with the tailings are gamma radiation, radon gas and its daughter products, and base metals and chemical wastes left from the milling process. The biological effects of radiation exposure at low dose rates is not well known, however, higher dose rates of gamma radiation or radon daughter products have been linked to cancer.

The radiation hazard from tailings lasts for many thousands of years, and some nonradioactive toxic chemicals persist indefinitely. The hazard from uranium tailings must be viewed in two ways. In themselves, the tailings pose a threat to the environment and to public health. Beyond this immediate, but generally limited, health threat, the tailings are vulnerable to human misuse and to dispersal by natural forces for an indefinite period. In the long run, this threat of expanded indefinite contamination overshadows the present dangers to public health. The Congressional report accompanying PL 95-604 expressed the view that the methods used for remedial actions should not be effective for only a short period of time. It states: "The Committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms," and that, "The committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."

Utah has historically supported the relocation of the tailings to a remote area. Former Governor Rampton and Governor Matheson have supported the relocation effort as have the Utah State Department of Health, Utah's Congressional Delegation, local governmental entities, and other civic groups.

Cost estimates for cleanup of uranium mill processing related problems exceed \$80 million 1981 dollars. Utah's share of this expense is 10 percent.

20.1 [It is concluded that it is not possible to stabilize the tailings in place and protect the environment and public health in perpetuity. In addition, the continued presence of the Vitro tailings pile within the Salt Lake metropolitan area represents a blight that will discourage development.

DEPARTMENT OF HEALTH

Position Paper for the Vitro Uranium Mill Tailings

1.0 Background Vitro Corporation of America, Salt Lake City Plant

1.1 Early Western Uranium Mills

The Salt Lake City plant of Vitro Chemical Corporation began processing uranium ore during 1951. It was one of the first western plants to begin production. The plant operated from 1951 through January, 1964 milling approximately 1.7 million tons of uranium ore. In mid 1965 the Atomic Energy Commission (AEC) announced that the AEC - Vitro Uranium Purchase Contract was terminated. The mill had not processed uranium ore since January, 1964. Vitro subsequently processed vanadium ore until 1968. Independent producers of uranium concentrates arranged to have their production shipped to the Atlas mill in Moab, Utah, after Vitro shutdown.

1.2 Vanadium Processing During 1964 - 1968

During the years 1964 to 1968, Vitro treated ferrophos from the Idaho phosphate industry to recover vanadium. The tailings from this operation were placed on the uranium tailings over a relatively limited area. Over 106,000 dry tons of ferrophos was treated during the time period.

1.3 Shutdown - 1968

During the summer of 1967, Vitro arranged with the adjacent sewage treatment plant to pump sludge onto the largest pile closest to the mill. This was necessary because the sewage treatment plant lacked technology and space to deal with the rapidly increasing volume of sludge coming from plant operations. Early in June, 1968, Vitro shut down the plant entirely.

2.0 Radioactive Tailings From Vitro's Mill Operation

2.1 Acid Leach/Solvent Extraction Method

Vitro's Salt Lake City plant used what is called an acid leach/solvent extraction method of extracting yellow cake (U_3O_8) from the uranium ores. Both mechanical and chemical processes were involved

in the milling operation. Initially the ore was crushed and ground, after which it was treated with a sulfuric acid leaching solution to extract the uranium. The leach liquor was purified and concentrated by solvent extraction and the uranium was recovered by chemical precipitation with the solid product calcined, pulverized and drummed for shipment as "yellow cake".

2.2 Tailings From Vitro's Mill Operation

The Vitro tailings represent liquid and solid chemical, radiological, and sandy wastes which have been discharged from the uranium mill. About 1.8 million tons of tailings are spread at varying depths over a 125 acre tract located immediately north of 3300 South and to the west of Interstate 15 in Salt Lake City. Some of the tailings have been used as fill-dirt in the construction of homes and businesses in Salt Lake Valley. In addition to small amounts of uranium and radium, the tailings contain significant concentrations of base metals. Arsenic, barium, chromium, vanadium, copper, iron, lead, manganese, silver, zinc, and cobalt have been detected in the tailings. Included in the volume of materials to be given remedial treatment are the uranium and vanadium tailings, soils underneath the tailings which have been contaminated through groundwater radionuclide migration, material excavated from off-site locations where tailings were used as fill-dirt, and contaminated sludges from the Central Valley Water Reclamation Facility's sewage treatment plant.

2.3 Radioactive Materials in Tailings

The radioactive materials present in the tailings are made up principally of radium and its daughter products, along with traces of uranium, as well as thorium.

The Vitro Corporation in correspondence with the AEC on August 7 and 11, 1959, disclosed that Vitro's measurement from two random samples showed the radium concentration to be 290 picocuries of radium per gram (290×10^{-12} gram of radium per gram of tailings). Vitro also indicated that the average uranium concentration of the tailings deposited in the collection area over the period from 1955 to 1959 averaged 0.029 percent U_3O_8 . Recent analyses suggest that various definable fractions exist in the tailings. Each fraction having a differing activity. Activity ranges from 200 pci/gr for sands to in excess of 2000 pci/gr for slimes have been reported.

E.C. Tsivoglou and R. L. O'Connell from the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio conducted a series of intensive and detailed in-plant surveys of six United States uranium mills for the specific purpose of characterizing the waste products of

the industry. They also have reported that in an acid leach/solvent extraction process (the process used by Vitro) that the major portion (98% to 99.5%) of the radium-226 input to the mill remains undissolved and in the tailings following the milling process. The slimes produced by this process have been found to contain a much higher concentration of radium-226 than that of the waste sand. Tsivoglou and O'Connell reported that, "...in general, the slimes, which comprise about a third of the waste solids, will contain 70% to 80% of the total radium originally present in the ore". This might explain why Vitro's northwest tailings exhibit a comparatively high gamma radiation level.

2.4 Volume of Tailings and Contaminated Soils

In as much as most of the ore processed ends up as tailings, there are approximately 1.8 million tons of waste material spread over 125 acres. An estimated one million tons of contaminated soil underlying the tailings must also be removed as will the estimated 340,000 tons of contaminated materials located at the 100 plus vicinity sites (off-site locations contaminated with tailings re: the Salt Lake County fire station.)

2.5 AEC Approved Use of Vitro Tailings for Construction

On October 28, 1971, the Subcommittee on Raw Materials of the Joint Committee on Atomic Energy met to discuss the use of uranium mill tailings for construction purposes. Emphasis was placed on tailings being used as land fill or in mortar mix particularly in the Grand

Junction, Colorado, area. As mentioned above the mill tailings contain radium and its daughter products from which radiation is released in the form of gamma rays and radon gas.

As a part of the record of the above mentioned hearing held in Washington, correspondence has been documented dealing with the disposal of mill tailings. An example is a letter from the Vitro Corporation of America, dated August 7, 1959, to the U.S. Atomic Energy Commission, in which Vitro requested approval of waste disposal procedures covering mill tailings from their site in Salt Lake City, Utah. In their August 7 letter they asked for permission from the AEC to let the Tolboe and Harlin Construction Company of Salt Lake City use tailings for fill material around the Salt Lake Suburban Sewer District facilities located just north of the plant. On September 1, 1959 the AEC issued the Vitro Corporation authorization pursuant to Sections 20.302, Part 20, Title 10, Code of Federal Regulations, to dispose of waste in the form of tailings from the Salt Lake City mill, in accordance with the procedures described in their letter of August 7, and as supplemented by other correspondence. The AEC stated that "...in as much as the waste in the form of tailings containing 0.029 percent uranium and trace quantities of thorium, it does not constitute source material, no license to receive this material need be obtained by either the Tolboe and Harlin Construction Company or the Salt Lake Suburban Sewer District."

Therefore, the AEC in 1959 apparently was not concerned at all about the presence of radium or its daughter products in these tailings! Two years later, in early, 1961, Utah health personnel began expressing concerns relating to groundwater contamination and occupational exposures.

By July of that year a strong position had been taken by the Utah Health Department. Dr. James D. Wharton, Interim Director of Public Health in correspondence with Luther L. Terry, M.D., U.S. Surgeon General remarked, "It has been proposed that this material be used as highway fill ... while this argument has certain elements of validity, we are seriously concerned about the future. In view of this problem, and in view of the recent information received by us that the AEC is planning to sell its refining plant at Monticello, Utah, it begins to become obvious that present and future generations are going to be faced with a very serious problem unless competent authority and decision can be established by State and Federal governments to regulate this problem area."

2.6 Potential for Economic Reprocessing

Preliminary DOE studies show that reprocessing of the Vitro tailings is not economical at present-day prices for uranium. Using what would currently be the most economical process (heap leaching) and

reprocessing the tailings at the disposal site, a firm would incur a net loss of \$26 million at present day uranium and vanadium prices. This loss would be in addition to the cost of stabilizing residues from reprocessing.

- 5.4 [Reprocessed residue tailings would remain with a high concentration of radium and other heavy metals that would result in the tailings still being classified as a radioactive hazardous waste.

3.0 Health Hazard from the Tailings Pile

3.1 Radiation Health Hazards

Two radiation health hazards exist at the site and vicinity properties. Gamma radiation and radon gas have both been associated with adverse health effects.

3.2 Gamma Radiation

The external health hazard is caused by the gamma radiation which is given off by radium-226 and its daughter products and reaches levels up to 3 mr. per hour immediately above the pile. It should be noted here

that the maximum allowable accumulated dose of external radiation to the whole body in unrestricted areas is 500 mr per year. The tailings pile is an unrestricted area in as much as the area is not suitably posted or fenced. It should also be mentioned that gamma levels up to .5 mr per hour (1,000 mr per working year) have been detected in vicinity properties. Levels outside of these buildings range from 14 μ r/hr all the way to 2.3 mr per hour. Early recommendations by the U.S. Surgeon General required remedial action wherever external gamma radiation levels exceed 0.1 mr./hr. Recently promulgated EPA Standards for Remedial Actions at Inactive Uranium Processing Sites require remedial action when gamma levels exceed 20 μ r/hr. above background. These standards would require that remedial action be taken at vicinity properties as well as at the Vitro Tailings pile.

3.3 Radon Gas

The most severe hazard to human health is the internal physiological hazard, caused by inhalation of radon gas, its daughter products, and associated dust particles. One of the biological effects of excess exposure to radon daughters can be lung cancer, considered to

be 100 percent fatal. It is, therefore, unfortunate that there is only a limited amount of experimental evidence or clinical documentation available regarding the consequence of chronic low-level exposures. There is a synergistic effect between radon and other cancer causing health hazards such as cigarette smoking and exposure to airborne asbestos. The inference is that, cigarette smoking coupled with radon exposure results in a 10 fold increased risk of lung cancer. This result is of current interest because of the marked synergism for lung cancer reported recently between cigarette smoking and exposure of the lungs to asbestos. Because of this, on February 18, 1970, the Department of Interior published standards for mandatory radiation limits to underground uranium mines under title 30, CFR 57. Smoking was prohibited underground, effective August 1, 1970.

3.4 Radon Equilibrium - A Function of Air Movement

Radon gas consisting of radon-222 and three short lived daughters is a hazard to health when the daughters become entrapped in the lungs. Their short half life means they will probably decay while in the respiratory tract. When air containing radon gas is allowed to stagnate, the daughters will approach equilibrium with radon-222. However, when there is air movement, such as exists out of doors, the daughters become less abundant with respect to radon and a lower percentage of equilibrium is reached.

The health hazard along with the measuring unit working level (WL), is dependent upon the percentage of equilibrium; therefore, as equilibrium is increased so is the health hazard and measured WL. The outside measurement is the minimum potential hazard. Whenever any building or enclosure is restricting the natural air movement, both the radon's equilibrium value and resulting health hazard will increase. A good example of the problem is the difference in the measured level (0.0075 WL) outside one of the buildings adjacent to the pile (the Won-Door building), and the measured level inside the building (0.469 WL), an increase of 6,000 percent! Just because the outside measurement is below the allowable level, there is no assurance that an enclosure built on the same site would also enjoy the same safe level. In fact, if the above case were to be used as a reference, the enclosure would have a level 60 times greater than the outside level.

The average radon release rate from the Vitro tailings pile is 670 pci/M^2 per second. This value exceeds the Final EPA standards for radon control (20 $\text{pci}/\text{M}^2 \text{ sec}$) by 33 times, obviously requiring remedial action.

3.5 EPA Requirements

Radon control shall be designed to:

- a. be effective for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years, and,
- b. provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:

1. exceed an average release rate of 20 pci/M² sec, or
2. increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half pci/liter.

These requirements clearly require remedial action at both vicinity properties and the tailings pile. Quoting further from these standards, "Judgments on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 CFR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

20.1 [These requirements make it extremely difficult if not impossible to stabilize the tailings on-site.

3.6 Engineering Radiation Control

While it is clear that engineering controls may be developed to drastically reduce the radiation emanating from the pile; Utah believes that other environmental concerns are not easily solved and in fact may not be quantifiable. Therefore, unresolved environmental issues will remain should the pile be stabilized in place.

4.0 Solutions for the Vitro Tailings Problems

4.1 A Permanent Solution is Needed

9.5 The radiation hazard from tailings lasts for many thousands of years, and some nonradioactive toxic chemicals persist indefinitely. The hazard from uranium tailings must therefore be viewed in two ways. In themselves, the tailings pose a present hazard to the environment and to human health. Beyond this immediate, but generally limited, health threat, the tailings are vulnerable to human misuse and to dispersal by natural forces for an indefinite period. In the long run, this threat of expanded indefinite contamination overshadows the present dangers to public health. The Congressional report accompanying P.L. 95-604 expressed the view that the methods used for remedial actions should not be effective for only a short period of time. It stated: "The Committee believes that uranium mill tailings should be treated...in accordance with the substantial hazard they will present until long after existing institutions can be expected to last in their present forms," and, that "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time." (H.R. Rep. No. 1480, 95th Cong., 2nd Sess., Pt. I, p.17, and Pt.II, p.40 [1978]).

There are, however, several alternative actions which could be taken for solving the problem in a quasi-permanent manner such as pile stabilization or removal from the current high-density population center to an area which could be forecasted to be remote for a number of years.

4.2. Vicinity Property Cleanup Begins 1981

Remedial actions in Salt Lake City began in 1981 with decontamination of the county fire station. This work continued during 1982 during which time 8 more contaminated properties were cleaned up. An estimated 90 vicinity sites remain for remedial action. Should the projected Federal timetable for vicinity property remedial action hold up, 14 properties will be decontaminated during Federal FY83 at a cost of approximately \$2 million. Vicinity sites will be cleaned during FY84 at a cost of \$6 million. The remainder will be accomplished during FY85 at an estimated cost of \$6 million. Utah's share of the remedial action costs will be 10 percent.

4.3 Federal Recommendations for Long Term Maintenance of the Vitro Tailings

Over the years a number of options have been discussed as being appropriate remedial measures to solve the tailings issue. These options have ranged from stabilization in-place to removal to a remote location.

Following the enactment of P.L. 95-604, the Uranium Mill Tailings Radiation Control Act of 1978, U.S. Department of Energy (DOE) advocated removal of the Vitro tailings to a remote site. In support of this position DOE prepared a Remedial Action Concept Paper (RACP) in June, 1981. The paper evaluated the following options:

1. Stabilization in place at the Vitro site;
2. Decontamination of the Vitro site and transfer of wastes to a new location;

5.2

Suboption 2A, Disposal in the prime area - The Great Depression,

20.9

Suboption 2B, Disposal in the first alternative area - south Clive,

Suboption 2C, Disposal in the second alternative area - South of Delle.

After considering the pros and cons of these options conclusions were reached on p. 14 ... "it appears that option 2B, Disposal at the First Alternative Area, is the economically and environmentally preferable action."

5.2 One year later in April, 1982 a second version of the RACP was
 20.9 produced. This version listed as the preferred option stabilization
 in-place, listing economic considerations as the overriding issue.

4.4 Utah's Position on Vitro Remedial Actions

As early as 1959 Utah's Health Agency began expressing concern over the public health and environmental impacts of the Vitro tailings pile.

By 1967 a position was already evolving with Lynn Thatcher, Deputy Director of Health, suggesting the only sound solution to the tailings issues was to avoid scattering of the tailings and to finally remove the pile to a remote area.

In September, 1973, Lyman J. Olsen, M.D., Director of Health was requesting studies to explore "...the feasibility of removing the tailings to a remote location."

October, 1973 saw the introduction of S.2566 by Senator Frank E. Moss, Utah, authorizing a cooperative agreement to solve Utah's Vitro tailings problem. By November, 1973 a moratorium on building was proposed for the area within a one-half mile radius of the tailings.

Testimony by Lyman J. Olsen, M.D., Director of Health before the Subcommittee on Raw Materials in March, 1974, advocated moving of the tailings pile. By July, 1974 policy was firmly established with Dr. Olsen stating, "...the appropriate action is removal of the tailings from this site for disposal in a remote area. Any other considerations are not acceptable to the State of Utah."

In a letter to the Nuclear Regulatory Commission (NRC) in January, 1975, Senator Moss requested immediate action that would result in removal of the radioactive tailings.

Since his election in November, 1975, Governor Scott M. Matheson has firmly supported the removal of the Vitro tailings to a remote location. A site for this relocation was selected by Utah in May, 1980.

After his election, Congressman Dan Marriott, Utah, began exploring the need for legislation at the Federal level dealing with the uranium mill tailings problem. By March, 1978, Marriott was holding Congressional Hearings on the subject and in April 1973 he introduced H.R. 12229, a bill to provide grants in aid to states for restoration of

abandoned uranium mill sites. This bill evolved into the Uranium Mill Tailings Radiation Control; Act of 1978. A bill that passed the Congress and was signed into law by the President. This law, Public Law 95-604, provides for remedial actions to be taken at Vitro and 23 other sites within the United States. Representative Dan Marriott has steadfastly supported decontamination of the Vitro site and transfer of wastes to a remote site.

Public Law 95-604 requires that each state nominate sites for tailings relocation should that be necessary. Utah, in May 1960, selected a primary site and two alternate sites. These sites were selected by the Vitro Tailings Site Selection Committee, a committee made up of professionals from pertinent Bureaus in the Division of Environmental Health and the Utah Geological and Mineral Survey Office.

The Committee using a complex numerical evaluation system rated over 24 different siting proposals. Siting options in western, central and southeastern Utah were considered. This process resulted in the selection of Great Depression as the primary site; alternate #1, 1 mile south of Clive; alternate #2, south of Delle.

These sites were submitted to DOE as Utah's preferred relocation site. Further evaluation by DOE resulted in the identification of the "South Clive" site as being geophysically superior for tailings placement.

4.5 Local Government and Organization Support for Tailings Relocation

Beginning in March, 1975, when the Women's State Legislative Council of Utah passed a resolution in support of relocation of the Vitro tailings to a remote site and continuing through 1982 when the Salt Lake City Commission, Salt Lake County Commission, West Valley City, Utah State Legislature, and others all passed resolutions in support of relocation of the Vitro tailings to an isolated, permanent site. The Utah position has historically been that the tailings must be relocated.

Governor Rampton met with Tooele County officials in September, 1976, and reviewed with them the possibility of placing the Vitro tailing pile in Tooele County. They agreed with the Governor that placing the tailings in the Great Depression area of Tooele County would have the least environmental impact. Several meetings have been held with the Tooele County Commission since then. Currently the Commission is not supportive of relocation of the tailings to Tooele County.

5.0 Federal Participation Needed

5.1 Benefits vs. Risks

The Vitro tailings pile in Salt Lake County is one of those tailings piles which resulted from the sudden demand for uranium during the

post-World War II era, where an increase in nuclear weapons production was called for in the United States. At that time technological efforts were concentrated on the development of ore refining facilities and economic refining processes with little attention being given to the materials which remained in the waste effluents from the mills; effective waste treatment or proper containment was lacking.

In perspective, the Vitro tailings pile represents an environmental problem which originated within a federally sponsored program. The U_3O_8 product was purchased solely by the federal government and the price of the product set by the government did not have built into it a sufficient amount for adequate reclamation, nor did the federal government recommend or provide funds for adequate reclamation following their abandonment of the Vitro site.

The federal government in sponsoring this raw materials program acted for and in behalf of the American people from whom it derives its purchasing power. The monetary costs were shared by the total populace and all of us also shared in the intended benefits derived from the program. Investigations now show the environmental risks have not been equally distributed and those in the Salt Lake Valley are experiencing a disproportionate share of the risks, especially the people who live or work in the immediate vicinity of the pile. The Vitro pile is the only abandoned uranium tailings site located in the center of a large metropolitan area!

5.2 Cost Estimates

Cost estimates for vicinity property cleanup and relocation of the Vitro tailings are presented below. The estimates include consideration of the remote site location, the special handling of contaminated material, the capabilities of local earthwork contractors, the site-specific subsurface conditions at the Vitro and South Clive sites and remedial action at vicinity properties. Anticipated resale value of purchased equipment, such as conveyor units, trackmobiles, railroad cars, etc. are also considered in the cost estimate.

10.1 The total construction cost plus engineering design (in 1981 dollars) and a 15 percent contingency is estimated to be \$87,381,000 including \$15,000,000 for vicinity property cleanup. The projected resale value of the purchased equipment is estimated to be about \$6,460,000 resulting in a total estimated projected cost of \$80,921,000.

Total Expenditures Federal & State in Millions of Dollars

<u>FY</u>	<u>Vicinity Sites</u> \$	<u>Vitro</u> \$	<u>Cumulative</u> <u>Total</u> \$
80-82	2.800	0	2.800
83	1.916	0	4.716
84	8.869	19.131	32.716
85	3.952	24.048	60.716
86	0	10.103	70.819
87	0	10.102	80.921

Utah's share of this projected cost is \$3,052,100 of which \$295,000 is now available in a nonlapsing fund for use during F.Y. 82. Utah furnished matching funds during FY80 to 82 in the amount of \$279,425.

5.3 Life Cycle Costing Study

10.2 Preliminary Life Cycle Costing studies conducted on the Vitr site by the Central Valley Water Reclamation Facility indicated that placement of a small, non-specialized industrial park on the 20 acre, fronting 33rd South would produce taxes and fees of about four million dollars per year. This results in "pay-back" of the increased cost of the tailings relocation within ten years, and production of over one billion dollars of useable funds over the next 100 years. A high technology park would produce funding at an accelerated rate. It should be stressed that this study is preliminary in nature and should only be considered an estimate until verified by independent review.

13.3 Greg Goodwin, Salt Lake County Planner, reports that the Vitr site is the prime industrial property in the Western United States.

6.0 Conclusions and Position

6.1 Conclusions

Protection of the public health for millenniums by the EPA standards cannot be assured in the Salt Lake metropolitan area with as much confidence as can be provided in a geophysically suitable remote rural area. In the urban area there would be a vastly greater problem with security (trespass, illegal off-site use of tailings, etc.) and a greater temptation to local government to modify the designated use of land as happened in the past. In addition, Salt Lake City lies in one of the most active seismic belts in the United States, with most of the activity being centered along the many individual faults of the Wasatch fault zone. One of these, the East Bench Fault, trends north and south along a line only 4 km east of the sites. In addition, an earthquake 6.2 could result in catastrophic damage to the underlying artesian aquifer such as changing the piezometric (water pressure gradient) level, 8.2 tailings liquifaction, or creating a direct pathway from the tailings to the groundwater. This possibility is greatly reduced by transporting the tailings away from the Wasatch Fault to an area of better geophysical stability. It is also almost certain that within fifty years it will be

necessary to draw water from the artesian aquifer; the upward pressure would be eliminated and contamination could seep into the strata should an impermeable layer not be placed under the tailings. Even placement of a synthetic impermeable layer cannot guarantee the integrity of the aquifer in perpetuity. Consideration of EPA's final standards for remedial action at tailings piles, specifically the section requiring stabilization as described in 47 CFR 32274, July 26, 1982, causes great concern over the feasibility of stabilization in place.

The continued presence of the Vitro tailings pile within the Salt Lake metropolitan area represents a blight that will discourage development, cause continuing public concerns and detract from the aesthetic values of the valley.

6.2 Position

3.1 These relationships represent the basis for the decision of the
20.1 Utah Department of Health to recommend the relocation of the Vitro
uranium mill tailings to a remote area. This will continue to be Health
Department policy unless it can be demonstrated that other options are
not only more cost effective, but will also absolutely protect the
environment and the public health for millennia into the future.

March 29, 1983

DRAFT EIS FOR REMEDIAL ACTIONS AT THE FORMER
VITRO CHEMICAL COMPANY SITE
SOUTH SALT LAKE, SALT LAKE COUNTY, UTAH

Written Comments

Foreword

Paragraph #3

Mention is made of expected design changes reflecting criteria contained in the final EPA standards for Remedial Action at Inactive Uranium Mill Tailings Sites and the lack of adequate data to predict future groundwater contamination probability and use patterns.

- 6.1 [Utah believes that any construction design changes indicated to meet EPA standards must be reviewed and approved. Additionally, the proposed "additional groundwater investigations" are inadequate in design and too short term to provide the needed data.

Page 5 - 1.2.2

- 3.1 [Discussion is made concerning the need to acquire "the industrial strip on 900 West Street." It will also be necessary to buy approximately 63.6 acres of property from the Central Valley Water Reclamation Facility Board (CVWRFB) at significant cost. Utah will not acquire the 69 acres necessary if stabilization on site is the preferred alternative or final decision made by DOE.
- 20.9 [

Page 6 - Table 1-1

Alternative 2, #7, estimated total cost (with clay liner for seepage control): \$22.5 million. Utah believes this cost to be under-estimated by as much as \$20.5 million.

Alternative 3, #9, estimated total cost

-On-site (Vitro Costs)
\$14.6 million
-Transportation to South Clive
\$23.8 million
-South Clive Stabilization
\$14.9 million
-Total
\$61.0 million

Utah believes these costs to be over-estimated by \$8 million.

-On-site
\$17.470 million
-Transportation
\$22.176 million
-South Clive
\$ 8.407 million
-Total
\$53.222 million

Page 5 - 1.2.2 continued on Page 8 (Reference Table 1-1, pg. 6)

- 9.8 [DOE presents a general description of the stabilization in-place option at the Vitro site. For cost comparison purposes an attempt has been made to examine identical stabilization criteria at both sites. A glaring error exists, however, in that at the Clive site partial burial (state of the art technology for uranium mill tailings) is used. This technology was not examined at the Vitro site apparently because of the great difficulty involved in construction and the associated high construction costs.

Page 9, - 1.3, paragraph 2

It should be noted that a building moratorium prevented development for several years in this area. The moratorium was relaxed recently by Salt Lake County after DOE assurances that the tailings would be removed.

Page 11, - 1.4, paragraph 5

"In both Alternative 2 and Alternative 3, groundwater systems might have to be protected by use of a clay liner that would reduce seepage ... the need for clay liners has not been demonstrated."

- 9.4 [9.1 Utah believes that the DEIS should address the need for a liner. If a liner is not used, the credibility of the design to last 1000 years is seriously questioned. In fact, with the tailings resting presently in the groundwater, Utah believes that stabilization in-place cannot confidently be addressed as an option lasting for the 200 year minimum specified period in the EPA standards. Since clay goes to a depth of 20-25' at the South Clive site, a clay liner there may not appear necessary. However, a clay liner is definitely necessary to protect groundwater at the Vitro site.

Pages 12-13 - Table 1-3

- 10.1 [Utah believes that project costs presented in Table 1-3 are not realistic. In developing the estimated cost projects DOE has not applied the same criteria to stabilization on-site (Alternative 2) and stabilization at South Clive (Alternative 3).

Page 14, last paragraph

- 10.1 [Costs of alternative options are presented. These costs are questioned by Utah. No attempt has been made at life-cycle costing which would show the true cost to society during the 1000 year planning cycle. The loss of the use of land in the Salt Lake Valley has a greater economic impact than the actual (not DOE's) difference in cost between Alternative 2 and Alternative 3.

Page 15, Last paragraph continued on Page 16

A quote indicative of Congressional intent is used, "uranium mill tailings located at active and inactive mill operations may pose a potential and significant radiation health problem to the public...". This quote does not go far enough to establish the intent of Congress.

- 9.5 [Utah believes that the Congressional report accompanying the Uranium Mill Tailings Act of 1978 (P.L. 95-604) should also be quoted because it more clearly defines the mood of Congress. "The Committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms." It continues, "The committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time." Emphasis added.

Page 16, paragraph 2, 3

- 10.2 [Discusses potential health effects ... "calculations suggest that the Vitro site contamination might produce 0.7 to 0.8 fatal cancers..."

- 10.2 [Utah suggests the potential 740 to 850 additional cancer-linked deaths must have some economic value - an issue totally ignored by the DEIS.

Page 16, paragraph 4, quoting Chairman J. M. Hendrie concerning health effects

- 14.2 [Here as well as throughout the DEIS the only health effects considered come from exposure to radionuclides. Potential health effects from other toxic species left in the tailings are totally ignored. The several heavy metals represent a far greater hazard to the underlying aquifers.

Page 19 3.1.1 EPA standards - including Tables 3-1 and 3-2

The DEIS attempts to address the final EPA standards. However, the DEIS fails to address the RCRA requirements found in the final EPA standards. RCRA requirements for siting and impoundment design have been totally ignored.

Page 30, 3.2.3.1, paragraph 1

- 9.8 ["...The water produced during emplacement could be temporarily stored in sumps near the excavations and pumped back into the excavated area after the granular working base is in place." Utah believes that any attempt to place a clay liner over a working base into which the excess groundwater has been pumped will fail. Also the groundwater will most certainly be contaminated by the tailings.

Page 45, paragraph 4

- 6.3 [Discusses impacts on ground and surface water ... "Alternatives 2 and 3 would not differ in their radiological and nonradiological impact on ground and surface water quality. Either alternative would meet the EPA standards. In any case, the ground and surface water systems involved do not contain potable water."

This statement is not supported by fact. Within a one-half mile radius there are 120 wells. Forty one of these wells are less than 120 feet deep and are being used for domestic purposes, irrigation and stock watering.

Page 72, paragraph 2

"The piezometric levels in March and April 1982 as measured in monitoring wells completed at a depth of approximately 60 feet, ranged from 1.0 to 12.0 feet above the existing ground surface. As a result, deep wells within the Vitro area are artesian and flow at the surface."

- 6.2 [When the City of South Salt Lake begins pumping their deep well (830 foot) at the Vitro site, the artesian conditions will change a great deal. With the deep aquifer being only "partially-confined" (as indicated in the DEIS) a serious contamination potential will exist.

Page 114, 5.3.1, paragraph 2 - "A 5.4 acre strip adjacent to the southwest side..."

The DEIS fails to mention the need to acquire 63.6 acres of property from CVWRB.

Page 119, 5.4.2. - Impacts on groundwater

This aspect is not adequately addressed in the DEIS. The Vitro site is underlaid by a thick sequence of unconsolidated Quaternary deposits. Bedrock below the site (which is buried under a thick sequence of alluvial deposits to at least 500 feet) consists of semiconsolidated clay, sand and gravel, interspersed with lava and cemented layers of sand and gravel. Within the unconsolidated section, two interrelated (but separate) groundwater flow systems have been identified. There is a shallow watertable system which occurs within the upper 10-30 feet of the unconsolidated alluvial materials. At the site the water table is shallow and typically 2-5 feet below the existing area grade and in places the tailings are in groundwater.

The primary direction of groundwater flow in both the shallow and deeper groundwater systems is to the west and northwest. The principal recharge mechanism to the deeper groundwater system is infiltration of precipitation and streamflow along the flank of the Wasatch Mountains. There is also an upward component of flow from the deeper to the shallow system because of the artesian pressure on the deeper system.

- 6.2 [Under the no action alternative, the degradation of groundwater quality would continue to exist. This potential is limited to the hydrogeologic setting. Upward gradient and migration precludes the deep downward migration of leachate and contaminants. If this upward

- 6.2 [gradient flow which currently exists was reversed, then degradation of the deeper aquifer would occur through leaching and infiltration. Increased pumping and groundwater withdrawals could cause a migration reversal which could result in serious groundwater contamination.

Another potential exists for lateral migration of leachate and contaminants within the shallow groundwater system beneath the site. Leachate generation would continue and metals, dissolved salts and radionuclides will exceed the EPA primary and secondary drinking water standards.

- 6.2 [Under the on-site stabilization alternative, deep groundwater contamination is minimized provided that increased deep groundwater withdrawals in the Vitro area do not reverse the upward hydraulic gradient or significantly reduce the artesian pressure.

- 9.4 [Use of clay liners to preclude leachate migration has not been tested enough over materials of untested quality such as the Vitro Tailings. The effectiveness of liners is suspect under conditions which exist on the Vitro site.

Page 119, last paragraph

- 6.1 [Reports indicate that the groundwater within and under the tailings is contaminated. Reference is made to a 2-3 month groundwater study designed and implemented in February 1983 to produce data adequate to predict long term groundwater movement and contamination. This study is too little too late. It is ludicrous to believe that a six to eight week study can produce data reliable enough to predict groundwater patterns during the present, let alone for hundreds of years into the future.

Page 124, 5.6 - Impacts on Land UseAlternative 2

- 5.2 [DOE has apparently forgotten that as early as 1975 decisions to move the Vitro tailings and allow other use of the land were made. The DEIS does not give adequate attention to long range planning by Salt Lake County for land use in the Vitro area. The DEIS glosses over the long range Master Plan of the CVWRB Board and acknowledges that the Board must change its plans in mid-construction but does not attempt to place a dollar value on this change if made. It may be that such a change is not possible, but certainly if possible the change would be costly.
- 13.1 [

Page 130, 5.9 - Impacts on Populations and Employment

Alternative 2

No attempt is made to analyze lost job opportunities by removing 69 acres of prime industrial property from use. An Economic Impacts Report prepared by Utah's Division of Community Development indicates a potential for employment on-site of 465 persons initially and over 900 within 20 years should this land become useful by removal of the Vitro tailings (attached).

Page 133, 5.11 - Impacts on Economic Structure

- 1.1 This section is too brief and poorly done. It has completely ignored economic issues vital to the appropriate assessment of economic impacts.

An economic study conducted by Utah's Division of Community Development reports:

According to the Utah Department of Health, health and safety risks will prohibit the economic development of all property adjacent to the on-site stabilization area, thereby constraining economic development of surrounding properties. Therefore, potential benefits to be realized from site development must be defined as the costs that society will incur if on-site stabilization is adopted.

- 10.2 The sum of capital investment, public revenues, and private sector income resulting from the economic development of the Vitro site will exceed \$697 million within 30 years if not constrained by on-site stabilization.

Total taxes, licenses, and user fees resulting from Vitro site development will exceed \$82.1 million within 30 years.

Total wages, land rents, and business profits resulting from Vitro site development will exceed \$178 million within 30 years.

Employment generated by site development will increase from 465 jobs initially to over 900 jobs within 20 years.

- 10.3 The differential cost of stabilization and decontamination (\$38.5 million) will be recovered in public sector revenues alone within ten years; total decontamination costs (\$61.0 million) will be recovered within 18 years (Note: This estimate uses DOE cost estimates. The State's own cost estimates certainly reduce the differential and allow for recovery within a much shorter time frame.)

The state's share of site decontamination costs (\$61.0 million) will be recovered in state income and sales taxes within 19 years.

Local public revenues will exceed \$53.7 million within 30 years.

Page 138, Alternative 2

..."By some revision of plans, the other uses proposed for the 128 acre tract could probably be accommodated;..." emphasis added.

It is extraordinarily expensive to change plans during construction. This proposal would lead to construction delays, increased engineering costs, and bid price changes.

Other uses for the tract could not be accommodated since the lands that are to be leased would not be available for that use. NRC would have the land under control for a seeming eternity.

Page A-10 - paragraph 1, 2, and Table A-3

A discussion of applicable EPA standards for remedial action at contaminated sites is given.

- 2.4 Major portions of the Final EPA Standard are not addressed nor is Congressional intent noted. The Uranium Mill Tailings Radiation Control Act reflects the desire of Congress (in Section 206) that EPA's standards be consistent, to the maximum intent practicable, with the Solid Waste Disposal Act.
- Subpart C -- Implementation of the Final EPA Standard 192.20, requires ..." Judgments on the possible need for remedial actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 CFR 32274, July 26, 1982) and by relevant state and Federal water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

No discussion, design criteria, or any other indication of consideration of RCRA appears in the OEIS.

- 2.4 Utah is adamant that RCRA requirements be carefully considered and applicable criteria be considered and implemented for any remedial action selected to stabilize the Vitro uranium mill tailings site.

Page A-11, A.3.1.2.

No reference is made to Utah's Bureau of Solid and Hazardous Waste Management, The State agency that administers RCRA. This agency has stringent requirements protecting the underlying aquifers at the Vitro or Clive sites.

Page A-14, A.4.1.3

"Two principal groundwater systems have been identified within the area of the Vitro site; a shallow water table system and a deeper partially-confined system (see Section 4.6.2). The water table in the upper, unconfined system ranges seasonally from about 2 to 5 feet below the existing ground surface and is locally above the base of the tailings throughout the year."

This statement is misleading since it only represents a single season observation. Actually, water table measurements taken during CVWRF design and construction (1980-1982) indicate a much broader groundwater surface fluctuation; elevations as low as 4,223 have been reported on the CVWRF site in the vicinity of the existing secondary sedimentation tanks. Also, since the primary direction of groundwater flow is northwest (i.e., toward Millcreek and the Jordan River), a strong potential exists for migration of any contaminant from the site to nearby surface waters if a total containment barrier is not provided.

Page A-33, paragraph 3

- 9.6 "In the analyses, consideration was given to the placement of a thin layer of the imported clay soils (Type 4) directly on top of the contaminated materials." DOE has not identified the source of Type 4 clay soils in Utah. Costs of importing from out of state could be prohibitive.

A-35 paragraph 2

- 9.1 Site stability of the Vitro site is examined. Nowhere in the presentation is reference made to problems associated with differential settlement of the proposed embankment.

Tests have been run at the site by the construction management firm for Central Valley Water Reclamation Facility Board. They have determined that there is considerable danger of differential settlement from the proposed stabilization loads. Their concerns are expressed below:

Estimated settlement @ CVWRFB site from stabilized load
29' high would be 15" maximum

Estimated settlement @ CVWRFB site from stabilized load
37' high would be 22" maximum

Settlement or consolidation could extend to a period of up to three years.

- 9.1 Underlying soil has lenses of sand, silt and clay and various mixtures. Shear strengths vary widely and the estimated settlements are based on empirical data from preload piles at site.

It is estimated that considerable damage to adjacent roadways, 33rd South and 900 West, could occur from soil settlement if the tailings were piled and stabilized in-place. This settlement could also damage utilities and other properties in the immediate area (within 150'). In addition, such differential settlement would jeopardize the integrity of any clay liner use for on-site stabilization.

Page A-40

The failure of a clay liner due to differential settlement was not discussed. How can the clay liner integrity be assured under these conditions?

Page 54 - Table A-17

Utah believes these costs to be severely underestimated. Table A-17 can be more accurately shown as:

Work or material	Quantity	Unit	Unit Price	Total
Mobilization	Job	lump sum	5% const. cost	\$ 962,000
Relocation of South Vitro Ditch	2,600	lineal ft	\$ 130	338,000
Excavation of contaminated material within stabilization area	1,533,000	cubic yds	3.50	5,366,000
Seepage-control lining				
Granular working base	335,000	cubic yds	4.50	1,508,000
Clay	335,000	cubic yds	6.00	2,010,000
Move other on-site tailings & contaminated material to stabilization area	1,000,000	cubic yds	3.50	3,500,000
On-site material transportation				
Portable conveyor units	25	each	30,000	750,000
Maintenance & operation	--	--	--	225,000
Restoration grading (imported material)	438,000	cubic yds	4.50	1,971,000
Cover stabilization area	670,000	cubic yds	4.50	3,015,000
Site security fence	7,300	lineal ft	8.00	58,000
Environmental Monitoring Equipment & installation	N/A	lump sum	--	500,000
Land Acquisition	69	acres	200,000	13,800,000
Buildings on 900 West	5	--		2,160,000
Dewatering				670,000
Relocation of Utilities				887,000
Relocation of unknown utilities				402,000
Total construction cost ^d				13,122,000
Contingencies @ 15%				5,718,300
Subtotal				43,840,300
Design-6.5%	Engineering and design @ 11%			4,822,433
Inspection-4.5%	Total Estimated Costs ^e			48,662,733
Resale of conveyors				375,000
Net Cost				48,287,733

^aIncludes demolition of buildings on industrial tract along 900 West.

^bIncludes \$0.50 per cubic yard for environmental and health requirements associated with working on exposed tailings materials.

^cSee footnote c to Table A-16.

^dDoes not include costs associated with construction dewatering, if required.

^eCost estimate is exclusive of land and right-of-way costs, legal and administrative costs, finance and interest costs, and vicinity-property cleanup.

Page A-90 & A-91 - Table A-26

Utah believes these cost estimates are too high. Utah's estimates place remedial action costs for Table A-26 as follows:

Work or material	Quantity	Unit	Unit Price	Total
VITRO SITE				
Mobilization of equipment	Job	lump sum	5% const. cost	832,000
Earthwork				
excavation of on-site contaminated materials and loading conveyor	2,533,000	cubic yds	\$4.00	10,132,000
Restoration grading (imported material)	1,068,000	cubic yds	\$4.50	4,806,000
On-site material transportation				
Portable conveyor units	35	units	\$30,000	1,050,000
Stacking conveyor	1	units	\$150,000	150,000
Rail car loaders with feed hoppers	2	units	\$50,000	100,000
Maintenance and operation ^{c,d}				400,000
				\$17,470,000

TRANSPORTATION TO SOUTH CLIVE SITE				
Rail construction at Vitro and South Clive				
Track	20,000	feet	\$52.00	1,040,000
Switches	6	units	\$15,000	90,000
Train costs				
Rail cars	165	units	\$42,000	6,930,000
Lids	165	units	\$9,000	1,485,000
Maintenance ^c				400,000
Rail transportation ^e	660	50-car train	\$16,115	10,636,000
Truck transportation of oversized contaminated material (concrete rubble)	118,000	tons	\$2.50	295,000
Wash down facilities equipment and construction	2		\$200,000	400,000
Well construction at South Clive	1		\$50,000	50,000
Maintenance and operation ^c				50,000
On-site rail car handling				
Track mobile	4	units	\$100,000	400,000
Maintenance and operation ^{c,d}				400,000
				<u>\$22,176,000</u>

SOUTH CLIVE SITE				
Mobilization of equipment	Job	lump sum	5% const. cost	400,000
Rotary dump equipment and construction	1	unit	\$1,115,000	1,115,000
Operation and maintenance ^{c,d}				200,000
On-site material transportation				
Portable conveyor units	35	units	30,000	1,050,000
Stationary stacker and feed hopper	1	unit	200,000	200,000
Mobile stacking conveyor	1	unit	400,000	400,000
Maintenance and operation ^{c,d}				600,000
Earthwork				
Excavation of pits & and placement of cover and liner	2,533,000	cubic yds	1.50	3,800,000
Stabilization cover	225,000	cubic yds	2.50	562,000
Security fence	10,000	lineal ft	8.00	80,000
				<u>48,053,000</u>
				Contingencies @ 15%
				7,208,000
				<u>55,261,000</u>
				Subtotal
				Engineering design @ 8%
				4,421,000
				<u>59,682,000</u>
				Total estimated cost
				6,460,000
				<u>\$53,222,000</u>

^aIncludes \$0.50 per cubic yard for environmental and health requirement associated with working on exposed tailings materials.

^bUnit cost is based on cost for select materials purchased from commercial quarry. Cost may be more or less at the time of construction depending on construction market and material availability.

^cMaintenance and operation projected for three-year operational period.

^dIncludes personnel salary for three-year period.

^eCost estimate from Western Pacific Railroad.

^fAssume 50 percent resale value on rail cars and conveyors units.

Appendix D - Hydrologic and Water Quality Information

- 6.1 Appendix D is incomplete, lacking data from the newly proposed and currently implemented groundwater study at the present Vitro site. Criteria specifying a limited time frame study (6-8 weeks) will provide questionable data for modeling the future groundwater condition at the Vitro site.

Appendix E - Socioeconomic Information

- 1.1 This appendix as well as Section 5.11, "Impacts on Economic Structure," do not meet NEPA requirements in that many potential economic impacts of stabilization on-site have been overlooked. Consequently, Utah's Division of Community Development prepared Economic Impacts of Alternative Remedial Actions for the Vitro Tailings, a report that closely examines economic concerns not examined in the DEIS. A copy of this report is attached.

In prepared remarks by Governor Scott M. Matheson, (see attached) mention was made of the lack of a hazardous materials analysis of the Vitro uranium mill tailings. Because the tailings fail the EPA's EP toxicity test, we must consider impacts to public health and to the environment caused by leachates from the tailings impoundment. This exclusion must be resolved.

- 8.1 We are also aware of grave concerns Utah's Geologic and Mineral Survey has concerning the seismic analysis included in the DEIS. This report, closely examining seismic studies, will also be included in Utah's written response to the DEIS.

Finally, environmentally, economically, and for the health of men, women and children now and for generations to come, stabilization in-place cannot be justified.

- 9.5 The Congressional report accompanying P.L. 95-604, expressed the view that the methods used for remedial actions should not have short-lived effectiveness. The report states, "The committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms." Continuing, "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."

- 20.1 We concur with that reasoning. We do not want future generations to be faced with a Salt Lake City Love Canal or Times Beach environmental disaster because we did not do the job right the first time. There will be no second chance. The only acceptable option for remedial action at the Vitro uranium mill tailings site is the immediate relocation to a remote, environmentally suitable location. There has been too much delay already. We must begin the relocation of these tailings this year.

In a position paper developed by the Department of Health in January 1983 (attached copy), the Vitro tailings are characterized as "a blight that will discourage development."



THE ATTORNEY GENERAL
STATE OF UTAH

MEMORANDUM

CONFIDENTIAL

TO: DR. JAMES MASON
LARRY ANDERSON
DEPARTMENT OF HEALTH

FROM: FRED NELSON *FN*
Assistant Attorney General

RE: Vitro Tailings Draft EIS Issues

DATE: March 21, 1983

DAVID L. WILKINSON
ATTORNEY GENERAL

PAUL M. TINKER
DEPUTY ATTORNEY GENERAL

RICHARD L. DEWSNUP
Solicitor General

FRANKLYN B. MATHESON, Chief
Governmental Affairs Division

ROBERT A. WALLACE, Chief
Legislation Division

WILLIAM T. EVANS, Chief
Human Resources Division

DONALD S. COLEMAN, Chief
Private Resources Division

MARK X. BUCHI, Chief
Tax & Business Regulation Division

Dr. James Mason
Page 2
March 21, 1983

2. Who will make the decision on the "preferred alternative?"

DOE. The State must concur in the remedial action plan per the cooperative agreement.

The President's Council on Environmental Quality may be asked to review the NEPA process, but it does not make the decision. It should be remembered that NEPA does not require the decisionmaker to select the most environmentally acceptable alternative. It simply requires that he take a "hard look" at environmental consequences through use of a management tool, the EIS. If the EIS presents the alternatives and fairly represents the consequences of each, the legal requirements have been met.

3. Does the availability of new information require preparation and circulation of a new draft?

The DEIS identifies that a groundwater monitoring program review is presently being undertaken. NEPA regulations, 40 C.F.R. 1502.9, require the preparation of supplements to either draft or final environmental impact statements if "there is significant new circumstances or information relevant to environmental concern and bearing on the proposed action or its impacts." It may be that the information acquired from the groundwater studies will require preparation of a new or supplemental draft with subsequent opportunity for public review and comment.

4. Is the draft EIS "legally adequate?"

This question was posed in the Central Valley Water Reclamation Facility Board list of issues. I am not sure what is meant by a "legally adequate draft." If reference is being made to whether procedural requirements have been met in issuance of the draft, no deficiencies have been brought to my attention. The purpose of the draft is to receive comment for purposes of correcting deficiencies in preparation of the final EIS. Based on my conversations with technical personnel, it would appear there are clearly some technical deficiencies in the draft. It is important that the State point out any known deficiencies. Whether

The following comments are provided on the Draft Environmental Impact Statement (DEIS) for Remedial Actions at the Vitro Site:

1. What is the consequence of not identifying a "preferred alternative" in the DEIS?

40 C.F.R. Section 1502.14(e) provides that the agency is required to "identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement...." DOE is not therefore required to identify the preferred alternative in the draft if one does not exist. It must, however, do so in the final EIS. When the final EIS is issued, it may be commented upon but no hearings need be scheduled.

The cooperative agreement between DOE and the State requires State concurrence on the selected remedial action plan. It would seem to be imperative for the State to either through administrative channels within DOE or through the political process attempt to insure that the preferred action selected by DOE is acceptable to the State. Neither DOE nor the State can afford selection of an alternative that the State would veto.

Dr. James Mason
Page 3
March 21, 1983

DOE adequately deals with those deficiencies will have to be addressed after issuance of the final EIS.

- 3.1 1.1 The State is in a difficult position with respect to the Vitro EIS. Usually, a legal challenge to an EIS is for the purpose of delay or to defeat a project. In this instance, delay is not in the State's interest. The State has the ability to veto any DOE proposal per the cooperative agreement, so a State challenge to the EIS would be meaningless. It should be remembered that a challenge to the EIS cannot force selection of one alternative over another except indirectly. The issue before the Court would be the adequacy of the statement, not which alternative should be selected. It would appear to be in the State's interest to help DOE prepare an adequate statement and apply whatever pressure it can to insure that the selected "preferred alternative" is acceptable to the State.

FGN/gh

LANGUAGE FOR STATE COMMENT -
DEIS VITRO TAILINGS

- 3.1 1. No "preferred alternative" is outlined in the draft. To adequately comment on environmental considerations it is necessary to understand the basis and rationale for a preferred alternative. It is imperative that the State participate in selection of the preferred alternative. Selection of the preferred alternative must be a coordinated effort between DOE and the State per the Cooperative Agreement which requires concurrence by the State on any selected remedial action plan. The public should then be allowed to comment on the "preferred alternative" and rationale underlying its selection before issuance of the Final EIS.
- 1.3 2. The DEIS identifies that a groundwater monitoring program review is presently being undertaken. NEPA regulations, 40 C.F.R. 1502.9, require the preparation of supplements to either draft or final environmental impact statements if "there is significant new circumstances or information relevant to environmental concern and bearing on the proposed action or its impacts." It may be that the information acquired from the groundwater studies will require preparation of a new or supplemental draft with subsequent opportunity for public review and comment.
- 10.1 3. The method of costing of alternatives appears to be deficient in many aspects, one of which is that land costs are not included. This omission and others results in a misleading costs comparison. (Needs to be expanded.)

Scott M. Matheson
Governor



James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS

Community Health Services
Environmental Health
Family Health Services
Health Care Financing

OFFICES

Administrative Services
Community Health Nursing
Management Planning
Medical Examiner
State Health Laboratory

STATE OF UTAH

DEPARTMENT OF HEALTH

150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110-2500

January 19, 1983

Honorable Scott M. Matheson
Governor of Utah
State Capitol
Salt Lake City, Utah 84114

Dear Governor Matheson:

Attached is the Department's position paper on remedial action for the Vitro uranium mill tailings.

Highlighted in the document is the importance of moving the tailings to a remote site away from Utah's major population centers. Although stabilization at its present urban location will prevent some hazards, this approach only addresses a part of the problem.

Long-term protection of the environment and mitigation of a serious urban blight can best be accomplished by removal of the tailings.

Sincerely,

James O. Mason, M.D., Dr.P.H.
Executive Director

Attachment

Vitro Uranium Mill Tailings
Remedial Action
Position Paper

UTAH DEPARTMENT OF HEALTH
January 17, 1983

James O. Mason, M.D., Dr.P.H.
Executive Director
Utah Department of Health

Marvin H. Maxell, Ph.D.
Acting Director, Division of
Environmental Health

Larry F. Anderson, M.P.A., C.I.H.
Assistant Director, Bureau of
Radiation Control

DEPARTMENT OF HEALTH
Position Paper for the Vitro Uranium Mill Tailings
January 17, 1983

INDEX

-2-

- 1.0 Background Vitro Corporation of America, Salt Lake City Plant
 - 1.1. Early Western Uranium Mills
 - 1.2. Vanadium Processing During 1964 - 1968
 - 1.3. Shutdown - 1968
- 2.0 Radioactive Tailings from Vitro's Mill Operation
 - 2.1. Acid Leach/Solvent Extraction Method
 - 2.2. Tailings from Vitro's Mill Operation
 - 2.3. Radioactive Materials in Tailings
 - 2.4. Volume of Tailings and Contaminated Soils
 - 2.5. AEC Approved Use of Vitro Tailings for Construction
 - 2.6. Potential for Economic Reprocessing
- 3.0 Health Hazards from the Tailings Pile
 - 3.1. Radiation Health Hazards
 - 3.2. Gamma Radiation
 - 3.3. Radon Gas
 - 3.4. Radon Equilibrium - A Function of Air Movement
 - 3.5. EPA Requirements
 - 3.6. Engineering Radiation Control
- 4.0 Solutions for the Vitro Tailings Problems
 - 4.1. A Permanent Solution is Needed
 - 4.2. Vicinity Property Cleanup Begins 1981
 - 4.3. Federal Recommendations for Long Term Maintenance of the Vitro Tailings
 - 4.4. Utah's Position on Vitro Remedial Actions
 - 4.5. Local Government and Organization Support for Tailings Relocation
- 5.0 Federal Participation Needed
 - 5.1. Benefits vs. Risks
 - 5.2. Cost Estimates
 - 5.3. Life Cycle Costing Study
- 6.0 Conclusions and Position
 - 6.1. Conclusions
 - 6.2. Position

January 17, 1983

Executive Summary

The Vitro plant processed uranium ores by acid leach/solvent extraction from 1951 to 1964. During this period, the plant processed 1.7 million dry tons of ore. In 1965, the mill was converted to the production of vanadium. Vanadium production ceased in 1968.

The tailings are made up of extremely fine sands, clays, and slimes. Quantities of tailings, contaminated materials, and miscellaneous debris are listed in this paper. Mention is made of Atomic Energy Commission permission to use tailings for construction purposes.

The recognized health hazards associated with the tailings are gamma radiation, radon gas and its daughter products, and base metals and chemical wastes left from the milling process. The biological effects of radiation exposure at low dose rates is not well known, however, higher dose rates of gamma radiation or radon daughter products have been linked to cancer.

The radiation hazard from tailings lasts for many thousands of years, and some nonradioactive toxic chemicals persist indefinitely. The hazard from uranium tailings must be viewed in two ways. In themselves, the tailings pose a threat to the environment and to public health. Beyond this immediate, but generally limited, health threat, the tailings are vulnerable to human misuse and to dispersal by natural forces for an indefinite period. In the long run, this threat of expanded indefinite contamination overshadows the present dangers to public health. The Congressional report accompanying PL 95-604 expressed the view that the methods used for remedial actions should not be effective for only a short period of time. It states: "The Committee believes that uranium mill tailings should be treated ... in accordance with the substantial hazard they will represent until long after existing institutions can be expected to last in their present forms," and that, "The committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."

Utah has historically supported the relocation of the tailings to a remote area. Former Governor Rampton and Governor Matheson have supported the relocation effort as have the Utah State Department of Health, Utah's Congressional Delegation, local governmental entities, and other civic groups.

Cost estimates for cleanup of uranium mill processing related problems exceed \$80 million 1981 dollars. Utah's share of this expense is 10 percent.

It is concluded that it is not possible to stabilize the tailings in place and protect the environment and public health in perpetuity. In addition, the continued presence of the Vitro tailings pile within the Salt Lake metropolitan area represents a blight that will discourage development.

DEPARTMENT OF HEALTH
Position Paper for the Vitro Uranium Mill Tailings

1.0 Background Vitro Corporation of America, Salt Lake City Plant

1.1 Early Western Uranium Mills

The Salt Lake City plant of Vitro Chemical Corporation began processing uranium ore during 1951. It was one of the first western plants to begin production. The plant operated from 1951 through January, 1964 milling approximately 1.7 million tons of uranium ore. In mid 1965 the Atomic Energy Commission (AEC) announced that the AEC - Vitro Uranium Purchase Contract was terminated. The mill had not processed uranium ore since January, 1964. Vitro subsequently processed vanadium ore until 1968. Independent producers of uranium concentrates arranged to have their production shipped to the Atlas mill in Moab, Utah, after Vitro shutdown.

1.2 Vanadium Processing During 1964 - 1968

During the years 1964 to 1968, Vitro treated ferrophos from the Idaho phosphate industry to recover vanadium. The tailings from this operation were placed on the uranium tailings over a relatively limited area. Over 106,000 dry tons of ferrophos was treated during the time period.

1.3 Shutdown - 1968

During the summer of 1967, Vitro arranged with the adjacent sewage treatment plant to pump sludge onto the largest pile closest to the mill. This was necessary because the sewage treatment plant lacked technology and space to deal with the rapidly increasing volume of sludge coming from plant operations. Early in June, 1968, Vitro shut down the plant entirely.

2.0 Radioactive Tailings From Vitro's Mill Operation

2.1 Acid Leach/Solvent Extraction Method

Vitro's Salt Lake City plant used what is called an acid leach/solvent extraction method of extracting yellow cake (U_3O_8) from the uranium ores. Both mechanical and chemical processes were involved

in the milling operation. Initially the ore was crushed and ground, after which it was treated with a sulfuric acid leaching solution to extract the uranium. The leach liquor was purified and concentrated by solvent extraction and the uranium was recovered by chemical precipitation with the solid product calcined, pulverized and drummed for shipment as "yellow cake".

2.2 Tailings From Vitro's Mill Operation

The Vitro tailings represent liquid and solid chemical, radiological, and sandy wastes which have been discharged from the uranium mill. About 1.8 million tons of tailings are spread at varying depths over a 125 acre tract located immediately north of 3300 South and to the west of Interstate 15 in Salt Lake City. Some of the tailings have been used as fill-dirt in the construction of homes and businesses in Salt Lake Valley. In addition to small amounts of uranium and radium, the tailings contain significant concentrations of base metals. Arsenic, barium, chromium, vanadium, copper, iron, lead, manganese, silver, zinc, and cobalt have been detected in the tailings. Included in the volume of materials to be given remedial treatment are the uranium and vanadium tailings, soils underneath the tailings which have been contaminated through groundwater radionuclide migration, material excavated from off-site locations where tailings were used as fill-dirt, and contaminated sludges from the Central Valley Water Reclamation Facility's sewage treatment plant.

2.3 Radioactive Materials in Tailings

The radioactive materials present in the tailings are made up principally of radium and its daughter products, along with traces of uranium, as well as thorium.

The Vitro Corporation in correspondence with the AEC on August 7 and 11, 1959, disclosed that Vitro's measurement from two random samples showed the radium concentration to be 290 picocuries of radium per gram (290×10^{-12} gram of radium per gram of tailings). Vitro also indicated that the average uranium concentration of the tailings deposited in the collection area over the period from 1955 to 1959 averaged 0.029 percent U_3O_8 . Recent analyses suggest that various definable fractions exist in the tailings. Each fraction having a differing activity. Activity ranges from 200 pci/gr for sands to in excess of 2000 pci/gr for slimes have been reported.

E.C. Tsivoglou and R. L. O'Connell from the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio conducted a series of intensive and detailed in-plant surveys of six United States uranium mills for the specific purpose of characterizing the waste products of

the industry. They also have reported that in an acid leach/solvent extraction process (the process used by Vitro) that the major portion (98% to 99.5%) of the radium-226 input to the mill remains undissolved and in the tailings following the milling process. The slimes produced by this process have been found to contain a much higher concentration of radium-226 than that of the waste sand. Tsivoglou and O'Connell reported that, "...in general, the slimes, which comprise about a third of the waste solids, will contain 70% to 80% of the total radium originally present in the ore". This might explain why Vitro's northwest tailings exhibit a comparatively high gamma radiation level.

2.4 Volume of Tailings and Contaminated Soils

In as much as most of the ore processed ends up as tailings, there are approximately 1.8 million tons of waste material spread over 125 acres. An estimated one million tons of contaminated soil underlying the tailings must also be removed as will the estimated 340,000 tons of contaminated materials located at the 100 plus vicinity sites (off-site locations contaminated with tailings re: the Salt Lake County fire station.)

2.5 AEC Approved Use of Vitro Tailings for Construction

On October 28, 1971, the Subcommittee on Raw Materials of the Joint Committee on Atomic Energy met to discuss the use of uranium mill tailings for construction purposes. Emphasis was placed on tailings being used as land fill or in mortar mix particularly in the Grand

Junction, Colorado, area. As mentioned above the mill tailings contain radium and its daughter products from which radiation is released in the form of gamma rays and radon gas.

As a part of the record of the above mentioned hearing held in Washington, correspondence has been documented dealing with the disposal of mill tailings. An example is a letter from the Vitro Corporation of America, dated August 7, 1959, to the U.S. Atomic Energy Commission, in which Vitro requested approval of waste disposal procedures covering mill tailings from their site in Salt Lake City, Utah. In their August 7 letter they asked for permission from the AEC to let the Tolboe and Harlin Construction Company of Salt Lake City use tailings for fill material around the Salt Lake Suburban Sewer District facilities located just north of the plant. On September 1, 1959 the AEC issued the Vitro Corporation authorization pursuant to Sections 20.302, Part 20, Title 10, Code of Federal Regulations, to dispose of waste in the form of tailings from the Salt Lake City mill, in accordance with the procedures described in their letter of August 7, and as supplemented by other correspondence. The AEC stated that "...in as much as the waste in the form of tailings containing 0.029 percent uranium and trace quantities of thorium, it does not constitute source material, no license to receive this material need be obtained by either the Tolboe and Harlin Construction Company or the Salt Lake Suburban Sewer District."

Therefore, the AEC in 1959 apparently was not concerned at all about the presence of radium or its daughter products in these tailings. Two years later, in early, 1961, Utah health personnel began expressing concerns relating to groundwater contamination and occupational exposures.

By July of that year a strong position had been taken by the Utah Health Department. Dr. James D. Wharton, Interim Director of Public Health in correspondence with Luther L. Terry, M.D., U.S. Surgeon General remarked, "It has been proposed that this material be used as highway fill ... while this argument has certain elements of validity, we are seriously concerned about the future. In view of this problem, and in view of the recent information received by us that the AEC is planning to sell its refining plant at Monticello, Utah, it begins to become obvious that present and future generations are going to be faced with a very serious problem unless competent authority and decision can be established by State and Federal governments to regulate this problem area."

2.6 Potential for Economic Reprocessing

Preliminary DOE studies show that reprocessing of the Vitro tailings is not economical at present-day prices for uranium. Using what would currently be the most economical process (heap leaching) and

reprocessing the tailings at the disposal site, a firm would incur a net loss of \$26 million at present day uranium and vanadium prices. This loss would be in addition to the cost of stabilizing residues from reprocessing.

Reprocessed residue tailings would remain with a high concentration of radium and other heavy metals that would result in the tailings still being classified as a radioactive hazardous waste.

3.0 Health Hazard from the Tailings Pile

3.1 Radiation Health Hazards

Two radiation health hazards exist at the site and vicinity properties. Gamma radiation and radon gas have both been associated with adverse health effects.

3.2 Gamma Radiation

The external health hazard is caused by the gamma radiation which is given off by radium-226 and its daughter products and reaches levels up to 3 mr. per hour immediately above the pile. It should be noted here

that the maximum allowable accumulated dose of external radiation to the whole body in unrestricted areas is 500 mr per year. The tailings pile is an unrestricted area in as much as the area is not suitably posted or fenced. It should also be mentioned that gamma levels up to .5 mr per hour (1,000 mr per working year) have been detected in vicinity properties. Levels outside of these buildings range from 14 μ r/hr all the way to 2.3 mr per hour. Early recommendations by the U.S. Surgeon General required remedial action wherever external gamma radiation levels exceed 0.1 mr./hr. Recently promulgated EPA Standards for Remedial Actions at Inactive Uranium Processing Sites require remedial action when gamma levels exceed 20 μ r/hr. above background. These standards would require that remedial action be taken at vicinity properties as well as at the Vitro Tailings pile.

3.3 Radon Gas

The most severe hazard to human health is the internal physiological hazard, caused by inhalation of radon gas, its daughter products, and associated dust particles. One of the biological effects of excess exposure to radon daughters can be lung cancer, considered to

be 100 percent fatal. It is, therefore, unfortunate that there is only a limited amount of experimental evidence or clinical documentation available regarding the consequence of chronic low-level exposures. There is a synergistic effect between radon and other cancer causing health hazards such as cigarette smoking and exposure to airborne asbestos. The inference is that, cigarette smoking coupled with radon exposure results in a 10 fold increased risk of lung cancer. This result is of current interest because of the marked synergism for lung cancer reported recently between cigarette smoking and exposure of the lungs to asbestos. Because of this, on February 18, 1970, the Department of Interior published standards for mandatory radiation limits to underground uranium mines under title 30, CFR 57. Smoking was prohibited underground, effective August 1, 1970.

3.4 Radon Equilibrium - A Function of Air Movement

Radon gas consisting of radon-222 and three short lived daughters is a hazard to health when the daughters become entrapped in the lungs. Their short half life means they will probably decay while in the respiratory tract. When air containing radon gas is allowed to stagnate, the daughters will approach equilibrium with radon-222. However, when there is air movement, such as exists out of doors, the daughters become less abundant with respect to radon and a lower percentage of equilibrium is reached.

The health hazard along with the measuring unit working level (WL), is dependent upon the percentage of equilibrium; therefore, as equilibrium is increased so is the health hazard and measured WL. The outside measurement is the minimum potential hazard. Whenever any building or enclosure is restricting the natural air movement, both the radon's equilibrium value and resulting health hazard will increase. A good example of the problem is the difference in the measured level (0.0075 WL) outside one of the buildings adjacent to the pile (the Won-Door building), and the measured level inside the building (0.469 WL), an increase of 6,000 percent! Just because the outside measurement is below the allowable level, there is no assurance that an enclosure built on the same site would also enjoy the same safe level. In fact, if the above case were to be used as a reference, the enclosure would have a level 60 times greater than the outside level.

The average radon release rate from the Vitro tailings pile is 670 pci/M² per second. This value exceeds the Final EPA standards for radon control (20 pci/M² sec) by 33 times, obviously requiring remedial action.

3.5 EPA Requirements

Radon control shall be designed to:

- a. be effective for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years, and,
- b. provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:

1. exceed an average release rate of 20 pci/M² sec, or
2. increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half pci/liter.

These requirements clearly require remedial action at both vicinity properties and the tailings pile. Quoting further from these standards, "Judgments on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 CFR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

These requirements make it extremely difficult if not impossible to stabilize the tailings on-site.

3.6 Engineering Radiation Control

While it is clear that engineering controls may be developed to drastically reduce the radiation emanating from the pile; Utah believes that other environmental concerns are not easily solved and in fact may not be quantifiable. Therefore, unresolved environmental issues will remain should the pile be stabilized in place.

4.0 Solutions for the Vitro Tailings Problems

4.1 A Permanent Solution is Needed

The radiation hazard from tailings lasts for many thousands of years, and some nonradioactive toxic chemicals persist indefinitely. The hazard from uranium tailings must therefore be viewed in two ways. In themselves, the tailings pose a present hazard to the environment and to human health. Beyond this immediate, but generally limited, health threat, the tailings are vulnerable to human misuse and to dispersal by natural forces for an indefinite period. In the long run, this threat of expanded indefinite contamination overshadows the present dangers to public health. The Congressional report accompanying P.L. 95-604 expressed the view that the methods used for remedial actions should not be effective for only a short period of time. It stated: "The Committee believes that uranium mill tailings should be treated...in accordance with the substantial hazard they will present until long after existing institutions can be expected to last in their present forms," and, that "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time." (H.R. Rep. No. 1480, 95th Cong., 2nd Sess., Pt. I, p.17, and Pt.II, p.40 [1978]).

There are, however, several alternative actions which could be taken for solving the problem in a quasi-permanent manner such as pile stabilization or removal from the current high-density population center to an area which could be forecasted to be remote for a number of years.

4.2. Vicinity Property Cleanup Begins 1981

Remedial actions in Salt Lake City began in 1981 with decontamination of the county fire station. This work continued during 1982 during which time 8 more contaminated properties were cleaned up. An estimated 90 vicinity sites remain for remedial action. Should the projected Federal timetable for vicinity property remedial action hold up, 14 properties will be decontaminated during Federal FY83 at a cost of approximately \$2 million. Vicinity sites will be cleaned during FY84 at a cost of \$6 million. The remainder will be accomplished during FY85 at an estimated cost of \$6 million. Utah's share of the remedial action costs will be 10 percent.

4.3 Federal Recommendations for Long Term Maintenance of the Vitro Tailings

Over the years a number of options have been discussed as being appropriate remedial measures to solve the tailings issue. These options have ranged from stabilization in-place to removal to a remote location.

Following the enactment of P.L. 95-604, the Uranium Mill Tailings Radiation Control Act of 1978, U.S. Department of Energy (DOE) advocated removal of the Vitro tailings to a remote site. In support of this position DOE prepared a Remedial Action Concept Paper (RACP) in June, 1981. The paper evaluated the following options:

1. Stabilization in place at the Vitro site;
2. Decontamination of the Vitro site and transfer of wastes to a new location;

Suboption 2A, Disposal in the prime area - The Great Depression,

Suboption 2B, Disposal in the first alternative area - south Clive,

Suboption 2C, Disposal in the second alternative area - South of Delle.

After considering the pros and cons of these options conclusions were reached on p. 14 ... "it appears that option 2B, Disposal at the First Alternative Area, is the economically and environmentally preferable action."

One year later in April, 1982 a second version of the RACP was produced. This version listed as the preferred option stabilization in-place, listing economic considerations as the overriding issue.

4.4 Utah's Position on Vitro Remedial Actions

As early as 1959 Utah's Health Agency began expressing concern over the public health and environmental impacts of the Vitro tailings pile.

By 1967 a position was already evolving with Lynn Thatcher, Deputy Director of Health, suggesting the only sound solution to the tailings issues was to avoid scattering of the tailings and to finally remove the pile to a remote area.

In September, 1973, Lyman J. Olsen, M.D., Director of Health was requesting studies to explore "...the feasibility of removing the tailings to a remote location."

October, 1973 saw the introduction of S.2566 by Senator Frank E. Moss, Utah, authorizing a cooperative agreement to solve Utah's Vitro tailings problem. By November, 1973 a moratorium on building was proposed for the area within a one-half mile radius of the tailings.

Testimony by Lyman J. Olsen, M.D., Director of Health before the Subcommittee on Raw Materials in March, 1974, advocated moving of the tailings pile. By July, 1974 policy was firmly established with Dr. Olsen stating, "...the appropriate action is removal of the tailings from this site for disposal in a remote area. Any other considerations are not acceptable to the State of Utah."

In a letter to the Nuclear Regulatory Commission (NRC) in January, 1975, Senator Moss requested immediate action that would result in removal of the radioactive tailings.

Since his election in November, 1975, Governor Scott M. Matheson has firmly supported the removal of the Vitro tailings to a remote location. A site for this relocation was selected by Utah in May, 1980.

After his election, Congressman Dan Marriott, Utah, began exploring the need for legislation at the Federal level dealing with the uranium mill tailings problem. By March, 1978, Marriott was holding Congressional Hearings on the subject and in April 1973 he introduced H.R. 12229, a bill to provide grants in aid to states for restoration of

abandoned uranium mill sites. This bill evolved into the Uranium Mill Tailings Radiation Control; Act of 1978. A bill that passed the Congress and was signed into law by the President. This law, Public Law 95-604, provides for remedial actions to be taken at Vitro and 23 other sites within the United States. Representative Dan Marriott has steadfastly supported decontamination of the Vitro site and transfer of wastes to a remote site.

Public Law 95-604 requires that each state nominate sites for tailings relocation should that be necessary. Utah, in May 1960, selected a primary site and two alternate sites. These sites were selected by the Vitro Tailings Site Selection Committee, a committee made up of professionals from pertinent Bureaus in the Division of Environmental Health and the Utah Geological and Mineral Survey Office.

The Committee using a complex numerical evaluation system rated over 24 different siting proposals. Siting options in western, central and southeastern Utah were considered. This process resulted in the selection of Great Depression as the primary site; alternate #1, 1 mile south of Clive; alternate #2, south of Delle.

These sites were submitted to DOE as Utah's preferred relocation site. Further evaluation by DOE resulted in the identification of the "South Clive" site as being geophysically superior for tailings placement.

4.5 Local Government and Organization Support for Tailings Relocation

Beginning in March, 1975, when the Women's State Legislative Council of Utah passed a resolution in support of relocation of the Vitro tailings to a remote site and continuing through 1982 when the Salt Lake City Commission, Salt Lake County Commission, West Valley City, Utah State Legislature, and others all passed resolutions in support of relocation of the Vitro tailings to an isolated, permanent site. The Utah position has historically been that the tailings must be relocated.

Governor Rampton met with Tooele County officials in September, 1976, and reviewed with them the possibility of placing the Vitro tailing pile in Tooele County. They agreed with the Governor that placing the tailings in the Great Depression area of Tooele County would have the least environmental impact. Several meetings have been held with the Tooele County Commission since then. Currently the Commission is not supportive of relocation of the tailings to Tooele County.

5.0 Federal Participation Needed

5.1 Benefits vs. Risks

The Vitro tailings pile in Salt Lake County is one of those tailings piles which resulted from the sudden demand for uranium during the

post-World War II era, where an increase in nuclear weapons production was called for in the United States. At that time technological efforts were concentrated on the development of ore refining facilities and economic refining processes with little attention being given to the materials which remained in the waste effluents from the mills; effective waste treatment or proper containment was lacking.

In perspective, the Vitro tailings pile represents an environmental problem which originated within a federally sponsored program. The U_3O_8 product was purchased solely by the federal government and the price of the product set by the government did not have built into it a sufficient amount for adequate reclamation, nor did the federal government recommend or provide funds for adequate reclamation following their abandonment of the Vitro site.

The federal government in sponsoring this raw materials program acted for and in behalf of the American people from whom it derives its purchasing power. The monetary costs were shared by the total populace and all of us also shared in the intended benefits derived from the program. Investigations now show the environmental risks have not been equally distributed and those in the Salt Lake Valley are experiencing a disproportionate share of the risks, especially the people who live or work in the immediate vicinity of the pile. The Vitro pile is the only abandoned uranium tailings site located in the center of a large metropolitan area!

5.2 Cost Estimates

Cost estimates for vicinity property cleanup and relocation of the Vitro tailings are presented below. The estimates include consideration of the remote site location, the special handling of contaminated material, the capabilities of local earthwork contractors, the site-specific subsurface conditions at the Vitro and South Clive sites and remedial action at vicinity properties. Anticipated resale value of purchased equipment, such as conveyor units, trackmobiles, railroad cars, etc. are also considered in the cost estimate.

The total construction cost plus engineering design (in 1981 dollars) and a 15 percent contingency is estimated to be \$87,381,000 including \$15,000,000 for vicinity property cleanup. The projected resale value of the purchased equipment is estimated to be about \$6,460,000 resulting in a total estimated projected cost of \$80,921,000.

Total Expenditures Federal & State in Millions of Dollars

<u>FY</u>	<u>Vicinity Sites</u>	<u>Vitro</u>	<u>Cumulative</u>
	\$	\$	Total
			\$
80-82	2.800	0	2.800
83	1.916	0	4.716
84	8.869	19.131	32.716
85	3.952	24.048	60.716
86	0	10.103	70.819
87	0	10.102	80.921

Utah's share of this projected cost is \$8,092,100 of which \$295,000 is now available in a nonlapsing fund for use during F.Y. 83. Utah furnished matching funds during FY80 to 82 in the amount of \$279,425.

5.3 Life Cycle Costing Study

Preliminary Life Cycle Costing studies conducted on the Vitro site by the Central Valley Water Reclamation Facility indicated that placement of a small, non-specialized industrial park on the 20 acres fronting 33rd South would produce taxes and fees of about four million dollars per year. This results in "pay-back" of the increased cost of the tailings relocation within ten years, and production of over one billion dollars of useable funds over the next 100 years. A high technology park would produce funding at an accelerated rate. It should be stressed that this study is preliminary in nature and should only be considered an estimate until verified by independent review.

Greg Goodwin, Salt Lake County Planner, reports that the Vitro site is the prime industrial property in the Western United States.

6.0 Conclusions and Position

6.1 Conclusions

Protection of the public health for millenniums by the EPA standards cannot be assured in the Salt Lake metropolitan area with as much confidence as can be provided in a geophysically suitable remote rural area. In the urban area there would be a vastly greater problem with security (trespass, illegal off-site use of tailings, etc.) and a greater temptation to local government to modify the designated use of land as happened in the past. In addition, Salt Lake City lies in one of the most active seismic belts in the United States, with most of the activity being centered along the many individual faults of the Wasatch fault zone. One of these, the East Bench Fault, trends north and south along a line only 4 km east of the sites. In addition, an earthquake could result in catastrophic damage to the underlying artesian aquifer such as changing the piezometric (water pressure gradient) level, tailings liquifaction, or creating a direct pathway from the tailings to the groundwater. This possibility is greatly reduced by transporting the tailings away from the Wasatch Fault to an area of better geophysical stability. It is also almost certain that within fifty years it will be

necessary to draw water from the artesian aquifer; the upward pressure would be eliminated and contamination could seep into the strata should an impermeable layer not be placed under the tailings. Even placement of a synthetic impermeable layer cannot guarantee the integrity of the aquifer in perpetuity. Consideration of EPA's final standards for remedial action at tailings piles, specifically the section requiring stabilization as described in 47 CFR 32274, July 26, 1982, causes great concern over the feasibility of stabilization in place.

The continued presence of the Vitro tailings pile within the Salt Lake metropolitan area represents a blight that will discourage development, cause continuing public concerns and detract from the aesthetic values of the valley.

6.2 Position

These relationships represent the basis for the decision of the Utah Department of Health to recommend the relocation of the Vitro uranium mill tailings to a remote area. This will continue to be Health Department policy unless it can be demonstrated that other options are not only more cost effective, but will also absolutely protect the environment and the public health for millennia into the future.



STATE OF UTAH
NATURAL RESOURCES & ENERGY
Utah Geological & Mineral Survey

606 Black Hawk Way - Salt Lake City, UT 84108 - 801-581-6831

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Genevieve Atwood, State Geologist

March 25, 1983

RECEIVED
DOCUMENT CONTROL

12 MAY 1983

MEMORANDUM

TO: Hunter Weller, State Planning Coordinator's Office

FROM: William R. Lund, Utah Geological and Mineral Survey

SUBJECT: Comments on Draft Environmental Impact Statement "Remedial Action at the Former Vitro Chemical Company Site, South Salt Lake, Salt Lake County, Utah (February, 1983).

COMMENTS PREPARED BY DON R. MABEY

- 8.3 [Page 58 and Table 4-1. The 1884, November 10, earthquake was not in Bountiful but near the Utah-Idaho border at least 100 km north of Bountiful. The 1910, May 22, earthquake was probably at about 40°44.94' and 111°50.95' well south of Bountiful and about 5 kms from the Vitro site. It had an estimated magnitude of 5.7. The 1975, March 28, event was in Pocatello Valley not at Pocatello, Idaho (another 100 km error). Damage reports clearly indicate that the 1958, December 1, event was near Nephi (another 100 km error).

These gross errors related to key seismic events negate much of the seismic risk analysis.

- 8.6 [Page 59. A critical structure designed for the Vitro site should anticipate a magnitude 7.5 event anywhere in the Salt Lake Valley.
- 8.4 [Page 59. Most of the earthquakes in Utah cannot be correlated with surface faults.

Page 64. Recreational use of the Jordan River should be considered "beneficial."

- 7.2 [Page 73. Long-term variations in the climate such as have occurred in last 1000 years might substantially raise the water table at the South Clive site.

Board: Kenneth R. Poulsen, Chairman
Laurence H. Latham
Peter E. Mathies



Robert W. Benick - Benton Boyd
Natalie A. Mallinckrodt
Elliot Rich

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- 8.6 [Page 116. The Proceedings of Conference X Earthquake Hazards Along the Wasatch and Sierra-Nevada Frontal Fault Zones convened under the auspices of the National Earthquake Hazards Reduction Program (1979) concluded: "If data from the complete earthquake catalogue (1850-1978) are used, they indicate return periods for the Wasatch Front area (92,810 km²) of 22 to 25 years for M_s 6.0, 111 to 115 years for M_s 7.0, and 232-263 years for M_s 7.5." The conclusion adds: "Comparison of ratios of velocity spectra between rock and alluvium in the period ranges of most interest in risk analysis suggests that ground response at sites on thick saturated alluvium such as exists beneath large parts of the Salt Lake city area can be ten times greater than at adjacent rock sites." See comment relative to page 59.

Page 122. See comment relative to page 73.

- 9.6 [Page 136. The sand, gravel and clay to be used at the Vitro site is a significant resource.

COMMENTS PREPARED BY BRUCE N. KALISER

- 8.6 [Page 59. A critical structure designed for the Vitro site should withstand a design earthquake of 7.5 in the Salt Lake Valley.
- 8.4 [Page 59. What reference indicates that "90% of the earthquakes which occurred in Utah between 1950 and 1965 were located along or in association with known fault zones"?
- 8.5 [Page 59. It should be pointed out that the Vitro site is not on rock, relevant to the 0.21 g.
- 8.1 [Page 59. It should read 21% g. or 0.21 g, not "0.21% g."
- 8.5 [Page 59 and 116. The USGS assigns a value for the Wasatch Front for horizontal bedrock acceleration with a 90% probability of not being exceeded in 50 years of 27% g.
- 8.5 [Page 59 and 116. A more reasonable approach for Vitro would be a more conservative one, using a 250 year, 90% probability acceleration. For bedrock the value would be 60% g.
- 8.6 [Page 63. The statement "Each of these earthquakes was of a magnitude comparable with what might be expected to be the maximum event produced by the faulting along the front of the Wasatch Range" is not true.
- Page 64. I am unable to address the question of flooding potential of the South Clive site without a firsthand knowledge of the on site and vicinity terrain - maps and other data may be inadequate to address this item.
- 7.6 [Page 73. With the water table at a depth of 25 to 35 feet how does one get ground-water discharge by evapotranspiration? - most unlikely!
- 19.5 [Page 74. "The high salinity of the ground water in the South Clive area may limit its use...." Change "may" to "will."

- 19.6 [Page 116 is in conflict with page 59 with respect to value of g assigned to Vitro site for horiz. acceleration in bedrock: 23 vs 21%. P. 116 reduces the value of g to 20% because of the valley fill section - would they now want to reduce it to 18%?
- 9.2 [Page 118. The statement, "for transient loading conditions such as the ones imposed by earthquakes, acceptable factors of safety range from 1.0 to 1.3" is incorrect and in conflict with P. A-69 which indicates that a F.S. "well in excess of 1.5 is generally accepted as the recommended minimum to ensure stability."
- 6.4 [Page A-20 and A-21. The possibility of dam breaks has not been considered; nevertheless, adding dam break discharge to a PMF in progress would not be an added factor because the cover elevation of 4260 feet would still exceed the most conservative flood elevation (4255'). The one new relevant factor is that flood water velocities (with dam break discharges) could reach 7 feet per second, thereby creating an erosion hazard.
- 9.1 [
- Page A-35. Sensitive clays, whether present or not on site, are not addressed.

- 6.5 [Page A-35. The last sentence of the second paragraph, "if a liquefaction incident were to occur in one of the discontinuous soil layers little evidence of liquefaction would be apparent and damage to the site would not be expected" is incorrect in my opinion.

COMMENTS PREPARED BY WILLIAM LUND

Section 4.6.2 Ground Water

- 11.5 [Page 72, paragraph 4. Radium-226 and radium-228 are reported in concentrations that exceed EPA-recommended drinking water standards from the deeper, partially-confined ground-water system. Does this indicate that the deeper system has been contaminated by past milling and tailings disposal activities at the Vitro site?
- 11.5 [Page 73, paragraph 2. Have any of the 121 domestic wells located within 0.5 mile of the Vitro site been tested for evidence of contamination? If the upper ground-water system and possibly the deeper system are contaminated (page 72 paragraphs 4 and 5), to what extent has the contamination plume migrated offsite and what are its potential health affects?
- 7.2 [Page 73, paragraph 3. The South Clive site is described as being similar to the Vitro site "from a hydrological point of view," but only one ground-water system is mentioned in the EIS. Is there a deeper, partially-confined ground-water system also present beneath the South Clive site, and if so what are its characteristics?

cc: Genevieve Atwood



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
Rockville MD 20857

APR 26 6 36 AM '83

APR 22 1983

Project Manager
UMTRA Project Office
U.S. Department of Energy
Albuquerque Operations Office
5301 Central Avenue, N.E., Suite 1700
Albuquerque, New Mexico 87108

Dear Sir:

The National Center for Devices and Radiological Health staff has reviewed the Draft Environmental Impact Statement (DEIS) related to the remedial actions at the former Vitro Chemical Company site, South Salt Lake County, Utah, DOE/EIS-0099-D, dated February 1983. Our assessment has been limited to the health and safety impacts associated with the proposed alternative remedial actions. We have the following comments to offer:

2.4 1. It appears the proposed remedial action will meet EPA standards for such actions at inactive uranium processing sites by consolidation of the tailings and stabilization of the newly created pile at the Vitro site (Alternative 1) or by moving and stabilization of the tailings material at a location south of Clive, Utah, and decontamination of the Vitro site (Alternative 2). Either alternative will reduce the normal average radonflux from the bare undisturbed Vitro tailings of about 670 pCi per square meter per second to less than the 20 pCi per square meter per second on top of the stabilized tailings as required by the EPA standard.

11.6 2. The environmental pathways identified in Section 5.1 and depicted in Figure 5-1 and Appendix F.2 cover all possible emission pathways that could impact on the population and remedial action workers during the 3-year period required to complete the remedial action. The source term data, computer codes (MILLOS and AIRREL) and methodology as described in related Appendixes have provided the means to make reasonable estimates of the radiological impact resulting from each of the alternatives. Results of these calculations are shown in Table 5.1 as estimates of 3-year excess population dose commitments and expected excess cancer deaths caused by the remedial action, and in Table 5.2 as estimates of 3-year excess population dose commitment to the remedial action worker and expected excess cancer deaths caused by the remedial action. It is considered appropriate to relate the excess population dose commitment and expected excess cancer deaths to those that are likely to result from the background radiation levels as presented in Table 5.3. From this comparison, it would appear that the radiological impact of the remedial action over the 3-year period is an acceptable risk. Furthermore, the data presented in Table F-21, Figures 9 and 10 show the reduction in whole body and organ dose in 10 receptor-directions for a 10-year period. The data in Figure 10 appear to indicate that the dose to the bronchial epithelium would be reduced from over 1000 mrem/to less than 10 mrem/year by the fourth and succeeding years.

Project Manager, UMTRA - Page 2

3. The radiological monitoring for the South Clive site is presented in Appendix F.1.2, and summarized in Table 4. The location of the environmental sampling programs is shown in Figure F-3. It appears that this program provides adequate sampling frequency and analyses for specific radionuclides to document the background radiation levels should Alternative 3 be selected for the remedial action. Section 3.1.2 states that the UMTRA requires NRC to license the final tailings disposal site following completion of the remedial action. Further, the NRC may require the DCE or other Federal agency having custody of such property and minerals to undertake such monitoring, maintenance, and emergency measures as necessary to protect public health and safety, and other actions as the NRC deems necessary. We believe a monitoring program should be conducted for a period of time following completion of the remedial action at the selected site to document that the releases from the sites meet the EPA standards. Therefore, it would be helpful to add a section in Appendix F that would indicate the programs that would be extended to the post remedial action period. We recognize that radiological monitoring after disposal is not required to demonstrate compliance as stated in Subpart A, Section 192.02, footnote 4 of 40 CFR 192.

16.1

4. Discussions in Section 5.1.5, Appendix F.2.3, on the radiological consequences in the event of accident during the transport of tailings to the South Clive site as described in Alternative 3, are considered to be (1) an adequate assessment of the radiation exposure pathways, and (2) a reasonable estimate of doses due to a hypothetical accidental spill of material on land (Table 20).

17.4 5. The mitigating measures during remedial actions as presented in Section 5.19.2 are considered to be important for radiation protection action in reducing the potential exposure of construction workers and to limiting public exposure. Experience from similar type activities involving radioactive material has demonstrated that this action is beneficial and should be fully implemented.

6. The protection of ground water from seepage of radioactive material is necessary to meet the EPA standard. Potential ground water contamination requires detailed examination as described in Section 3.1.4 to assure that adequately engineered barriers are provided to prevent seepage from the disposal site. We believe the discussions in Section 5.4.3 and Appendixes A.4.2.2 and A.5.2.2 have adequately addressed this in the conceptual design, and that it provides assurance that such design will provide protection of the public health and the environment.

Thank you for providing the NCDRH the opportunity to review and comment on this Draft Environmental Impact Statement.

Sincerely yours,

John C. Villforth
John C. Villforth
Director
National Center for Devices
and Radiological Health

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GLOSSARY

absorbed dose, radiological	Radiation energy absorbed per unit mass, usually given in units of rads.
acceleration	In this report, the action of gravity in units of velocity per time squared.
alluvium	Unconsolidated detrital deposits resulting from operations of modern rivers.
alpha particle	A positively charged particle emitted from certain radio-nuclides. It is composed of two protons and two neutrons, and is identical to the helium nucleus.
animal-unit month	The amount of feed or forage required by one mature cow and calf for one month.
anticline	A fold in the underground rock structure that is convex upward. Its core contains the stratigraphically older rocks.
aquifer	A subsurface formation containing sufficient saturated permeable material to yield significant quantities of water.
aquitard	A confining bed that retards but does not prevent the flow of water to or from an aquifer.
atom	A unit of matter; the smallest unit of an element consisting of a dense, central, positively charged nucleus surrounded by a system of electrons, equal in number to the number of nuclear protons and characteristically remaining undivided in chemical reactions except for limited removal, transfer, or exchange of certain electrons.
A-weighted sound levels	A method of measuring sound intensity that simulates an individual's sound perception.
background radiation	Radiation arising from radioactive material other than that under consideration. Background radiation due to cosmic rays and natural radioactivity is always present, and there may also be background radiation due to the presence of radioactive substances in building materials, etc.
beta particle	Charged particle emitted from the nucleus of an atom, with mass and charge equal to those of an electron.
blow counts	The number of blows of a drop hammer to advance a soil penetrometer as detailed in the Standard Penetration Test (ASTM D1586).

boundary seismicity	Seismicity which is associated with the boundary between two structural and/or physiographic provinces; for example, seismic events along the Wasatch Front, the physiographic boundary between the Colorado Plateau and the Basin and Range Province.
colluvium	Rock fragments, sand, and soil that accumulate on steep slopes or at the foot of hills.
confined aquifer	An aquifer bounded above and below by relatively impermeable beds.
contamination	In this report, the presence of radioactive material in concentrations above natural levels.
curie (Ci)	A unit of radioactive disintegration; 3.7×10^{10} disintegrations per second.
Dames & Moore	An engineering and environmental consultant firm with an office in Golden, Colorado.
daughter product(s)	A nuclide resulting from radioactive disintegration of a radionuclide, formed either directly or as a result of successive transformations in a radioactive series; it may be either radioactive or stable.
decay, radioactive	Disintegration of the nucleus of an unstable nuclide by spontaneous emission of charged particles, photons, or both.
decibel (dB)	A unit used to express power or intensity ratios in electrical and acoustical technology.
decontamination	The reduction of radioactive contamination to a predetermined level set by a standards-setting body such as the EPA.
densification	The process of compacting loose soil materials.
disintegrations per minute or second	The number of radioactive decay events occurring per minute or second.
disposal	The planned safe permanent placement of radioactive waste.
dose	A general term denoting the quantity of radiation or energy absorbed; for special purposes, it must be qualified; if unqualified, it refers to absorbed dose.
dose, absorbed	The amount of energy imparted to matter by ionizing radiation per unit mass of irradiated material at the point of interest; given in units of rads.
dose commitment	The cumulative dose equivalent that results and will result from exposure to radioactive materials over a discrete time period; given in units of rems.

dose equivalent	The quantity that expresses all kinds of radiation on a common scale for calculating the effective absorbed dose; defined as the product of the absorbed dose in rads and modifying factors, especially the qualifying factor; given in terms of rems. Often abbreviated "dose."
electron	A negatively charged particle found either free or surrounding the nucleus of an atom.
excess lifetime cancer deaths	The number of cancer deaths occurring in the lifetime of a particular population that is in excess of the number normally expected.
exposure	The presence of radiation that may deposit energy in an individual; given in units of roentgens.
external dose	The absorbed dose or dose commitment that is due to a radioactive source external to the individual as opposed to radiation emitted by inhaled or ingested sources.
fault	A surface or zone of rock fracture along which there has been movement.
flood plain	Lowland or relatively flat areas that are subject to a 1 percent or greater probability of flooding in any given year (i.e., a 100-year or more common flood).
flow slide	The rapid failure of soil due to rapid strength loss and the resulting translational movement of that mass. Flow slides are often caused by liquefaction within a soil mass resulting from dynamic loading such as from an earthquake.
flux, radon	The emission of radon gas from the earth, usually measured in units of picocuries per square meter per second.
g Units	A unit of acceleration equal to the standard acceleration of gravity.
gamma dose	Radiation dose caused by gamma radiation.
gamma ray or radiation	High energy electromagnetic radiation emitted from some radionuclides. The energy levels are specific for different radionuclides.
graben	A block of the earth's crust, generally with a length much greater than its width, that has dropped relative to the blocks on either side.
ground water	Water below the land surface, generally in a zone of saturation.
hopper	A railroad car that dumps its load from the bottom of the car.

horst	A block of the earth's crust uplifted along faults relative to the rocks on either side.
half-life	The time it takes for 50 percent of the quantity of a radionuclide to decay into its daughters.
hypocentral distance	The distance to an earthquake focus from a given point.
in situ	In the natural or original position.
internal dose	The absorbed dose or dose commitment resulting from inhaled or ingested radioactivity.
isotopes	Nuclides having the same number of protons in their nuclei, but differing in the number of neutrons: the chemical properties of isotopes of a particular element are almost identical.
lacustrine	Soil produced, or formed, in a lake.
lenticular	Generally a laterally discontinuous rock or soil unit or bed.
licensing	In this report, the process by which the NRC will, after the remedial actions are completed, approve the final disposition and controls over a disposal site. It will include a finding that the site does not and will not constitute a danger to the public health and safety.
lineament	Any line on the ground or on an aerial photograph, that is structurally controlled.
liquefaction	A change in the phase of a soil unit from a solid mass to a viscous mass due to increases in soil water pore pressure.
liquid limit	The minimum amount of water which has to be mixed with a sediment or soil so that, under standard conditions of test (ASTM D423), the material becomes capable of flowing like a liquid.
man-rem (person rem)	Unit of population exposure obtained by summing individual dose-equivalent values for all people in the population. Thus, the number of man-rem attributed to 1 person exposed to 100 rems is equal to that attributed to 100 people each exposed to 1 rem.
maximum credible earthquake	The earthquake of the greatest magnitude that is predicted to occur along a known fault system.
micro	A prefix meaning one millionth ($\times 1/1,000,000$ or 10^{-6}).
microseismic	Seismic events of very low Richter magnitude.

milli	A prefix meaning one thousandth ($\times 1/1000$ or 10^{-3}).
Modified Mercalli (scale)	A standard scale for the evaluation of the local intensity of earthquakes based on observed phenomena such as the resulting level of damage. Not to be confused with magnitude, such as measured by the Richter scale, which is a measure of the comparative strength of earthquakes at their sources.
normal faulting	A fault where the hanging wall moves downward relative to the footwall.
nucleus	The positively charged center of an atom.
nuclide	A kind of atom characterized by the constitution of its nucleus. It is specified by the number of protons and the number of neutrons in the nucleus.
off-site property	(See vicinity property)
ordinary method-of-slices analyses	A method to determine slope stability where the slopes are analyzed as a group of vertical slices. The driving and resisting forces of each slice are calculated using basic static equilibrium equations. The factor of safety is determined as the ratio of the resisting forces to the driving forces.
passive controls	Those controls which inhibit human contact with the waste and depend on a continuing social order. Examples include Federal ownership of a disposal site, monuments on the site, records with agencies, and physical barriers (e.g., riprap, covers, waste burial).
permeability	The ease with which liquids or gases penetrate or pass through a solid material. Technically, it is the volume of fluid that will flow through a unit area under a unit hydraulic gradient, measured in centimeters per second or equivalent units.
permissible dose	That dose of ionizing radiation that is considered acceptable by standards-setting bodies such as the EPA. Also, the dose of radiation that may be received by an individual within a specified period with the expectation of no substantially harmful result.
person-rem	Same as man-rem.
pico	A prefix meaning one trillionth ($\times 1/1,000,000,000,000$ or 10^{-12}).
picocurie	A unit of radioactivity defined as 0.037 disintegrations per second.

population dose (exposure)	The sum of individual radiation doses received by all of those exposed to the source of interest.
pore water pressure	Stress or pressure within a soil or rock mass due to the pressure of interstitial fluid.
potentiometric surface	That surface represented by the static water-level in wells tapping a saturated geologic formation or aquifer.
probable maximum flood	The hypothetical flood (peak discharge, volume, and hydrograph shape) that is considered to be the most severe reasonably possible, based on comprehensive hydrometeorological application of probable maximum precipitation (PMP) and other hydrologic factors favorable for maximum flood runoff such as sequential storms and snowmelt.
probable maximum precipitation	The estimated depth for a given duration, drainage area, and time of year for which there is virtually no risk of exceedance.
proton	An electrically positive elementary particle found in the nucleus of an atom. Also, the nucleus of a hydrogen atom.
quality factor (QF)	The principal modifying factor by which absorbed doses are multiplied to obtain dose equivalents for radiation-protection purposes and thus express the effectiveness of absorbed doses on a common scale for all kinds of ionizing radiation. The quality factor depends on the type and the energy of the radiation being considered.
rad	A unit of measure for the absorbed dose of radiation. It is equivalent to 100 ergs per gram of material.
radioactivity (radioactive decay)	The property of some nuclides of spontaneously emitting particles or gamma radiation or of spontaneous fission.
radioisotope	A radioactive isotope of an element with which it shares almost identical chemical properties.
radionuclide	A radioactive nuclide.
radium-226	A radioactive daughter product of uranium-238. Radium is present in all uranium-bearing ores; it has a half-life of 1620 years.
radon-222	The gaseous radioactive daughter product of radium-226; it has a half-life of 3.8 days.
radon-daughter product	One of several short-lived radioactive daughter products of radon-222. All are solids.

rem	A unit of dose equivalent equal to the absorbed dose in rads times quality factor times any other necessary modifying factor. It represents the quantity of radiation that is equivalent in biological damage to 1 rad of x-rays.
Richter magnitude	A measure of the total energy released by an earthquake.
roentgen	A unit of measure of ionizing radiation in air; 1 roentgen in air is approximately equal to 1 rad and 1 rem in tissue.
safety factor	A classification of stability based on the ratio of resistant forces to driving forces where a ratio greater than 1 indicates non-failure.
sands	In this report, relatively coarse-grained waste products of uranium-ore processing.
secular equilibrium	The condition of a radionuclide decay chain in which the rate of decay of any radioactive product is just equal to its production from the previous member of the chain.
seismicity	Phenomena of earth movements.
seismogenic	Said of a geologic setting or structure which has been or could be the locus of seismic activity. For example, an active fault is considered the potential seismogenic source for future earthquakes.
seismotectonic	Adjective used to describe the relationship between seismicity and the geologic structural fabric of the earth.
shear resistance	Resistance to displacement by a shear stress.
shear stress	A stress causing or tending to cause two adjacent parts of a solid to slide past one another parallel to the plane of contact.
slimes	In this report, fine-grained waste materials from uranium-ore processing that are mixed with small amounts of water.
South Clive site	A site 3 miles south of a rail point called Clive on the eastern edge of the Great Salt Lake Desert and about 85 road miles west of Salt Lake City, Utah. It has been nominated by the State of Utah as a possible site for permanently disposing of the radioactive material from the Vitro site.
Standard penetration test	A test to determine the relative values of soil density based on the numbers of blows of a standard force necessary to drive a shaft a standard distance into the soils.
syncline	A fold in the rock structure that is concave upward.

tailings, uranium-mill	The wastes remaining after most of the uranium has been extracted from uranium ore.
tectonics	Study of the deformation of the major structural features of the Earth's crust or broad structure of a region.
tectonic stress	The force per unit area transmitted to strata during seismic or earthquake activity.
thorium-230	A radioactive-daughter product of uranium-238; it has a half-life of 80,000 years and is the parent of radium-226.
total overburden stress	The force per unit area caused by the weight of the overlying rock or soil.
transmissivity, hydraulic	A measure of the ability of an aquifer to transmit water equal to the product of the permeability and the thickness of the aquifer, expressed in gallons per day.
unconfined aquifer	An aquifer that is not confined by impermeable beds. The upper surface is called the water table.
Unified Soil Classification System	The generally accepted system for the classification of soils based on grain size, size distribution and plasticity properties adopted by the U.S. Army Corps of Engineers and the Bureau of Reclamation.
uranium-238	A naturally occurring radioisotope with a half-life of 4.5 billion years; it is the parent of uranium-234, thorium-230, radium-226, radon-222, and others.
vicinity property	A property in the vicinity of the Vitro site which is determined by the DOE, in consultation with the NRC, to be contaminated with residual radioactive material derived from the Vitro site, and which is determined by the DOE to require remedial action.
Vitro site	A site in South Salt Lake, Utah, containing radioactive residues left from operations of the Vitro Chemical Co. plant, which extracted uranium from various ores for the U.S. Atomic Energy Commission. It has been designated as requiring remedial action under UMTRCA.
water table	The potentiometric surface in an unconfined aquifer.
working level (WL)	A measure of radon-daughter-product concentrations. Technically, it is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of alpha particles with a total energy of 130,000 MeV.

working-level
month (WLM)

Exposure resulting from inhalation of air with a concentration of 1 WL of radon daughters for 170 working hours. Continuous exposure of a member of the general public to 1 WL for one year results in approximately 50 WLM of exposure; 1 WLM is approximately equal to 5 rem.

ABBREVIATIONS AND ACRONYMS

AAR	American Association of Railroads
ADT	Average Daily Traffic (trips)
AEC	U.S. Atomic Energy Commission
ANL	Argonne National Laboratories
ANS	American Nuclear Society
AQCR	Air Quality Control Region
BAR	Basin and Range
BEIR	Advisory Committee on the Biological Effects of Ionizing Radiation of the National Academy of Sciences (also their report)
BLM	Bureau of Land Management, U.S. Department of Interior
BOD	Biological oxygen demand
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CO	Carbon monoxide
CVWRF	Central Valley Water Reclamation Facility, Salt Lake City, UT
dBa	Decibels on the A scale; a logarithmically based unit of sound intensity weighted to account for human auditory responses
DOE	U.S. Department of Energy
DOI	U.S. Department of Interior
EA	Environmental assessment
EGR	External gamma radiation
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
F&WS	U.S. Fish and Wildlife Service
FBDU	Ford, Bacon and Davis Utah Inc.
FEMA	Federal Emergency Management Agency
FR	Federal Register
g	Grams, a unit of weight = 0.035 ounce; also a measure of acceleration, 1 g = 32 feet per squared second
gpm	gallons per minute
HC	Hydrocarbon
HEC	Hydrologic Engineering Center
HELP	Hydrologic Evaluation of Landfill Performance
HEW	U.S. Department of Health, Education and Welfare
HUD	U.S. Department of Housing and Urban Development
kWh	Kilowatt hours
l	Liter; a unit of volume = 1.057 quarts
LASL	Los Alamos Scientific Laboratory
L _{dn}	Day-night sound level, measured in decibels

m	Meter; a unit of length = 3.28 feet; also milli, a prefix meaning one-thousandth (10^{-3})
MCE	Maximum Credible Earthquake
MeV	Million electron volts
mg	Milligrams; a thousandth of a gram
mgd	Million gallons per day
MILDOS	A computer code used to calculate both the spread of radon and particulates in the atmosphere and the consequent radiation doses
MMI	Modified Mercalli Intensity; a measure of earthquake intensity
MPC	Maximum permissible concentration
mR/hr	Milliroentgens per hour
MSRD	Mountain States Research & Development Company, Tucson, Arizona
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969 (PL 91-190)
NOAA	National Oceanic and Atmospheric Administration
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Agency
O ₃	Ozone
ORNL	Oak Ridge National Laboratory, Oak Ridge, Tennessee
P	Pico, a prefix meaning one-trillionth (10^{-12})
Pb	Lead
pCi/g	Picocuries per gram
pCi/l	Picocuries per liter
pH	A logarithmic scale of hydrogen-ion concentration, and hence, an indication of acidity or alkalinity: pH = 7 is neutral; pH less than 7 is acidic; pH greater than 7 is alkaline
PERM	Passive environmental radon monitor
PL	Public Law
Po	Polonium
PMF	Probable maximum flood
PMP	Probable maximum precipitation
RA	Remedial action
RAECO	Rogus and Associates Engineering Company
Ra-226	Radium-226
RAC	Remedial Action Contractor
RDC	Radon-daughter concentration
Rn-222	Radon-222
Sandia	Sandia National Laboratories, Albuquerque, New Mexico
SCS	U.S. Soil Conservation Service
SH&B	Sergeant, Hanskins & Beckwith
SMSA	Standard Metropolitan Statistical Area
SO ₂	Sulfur dioxide
TAC	Technical Assistance Contractor
TDS	Total dissolved solids
Th	Thorium

TLDS	Thermoluminescent dosimeters; a device for measuring radiation
TOC	Total organic carbon
TSP	Total suspended particulates
TSS	Total suspended solids
UBC	Uniform Building Code
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
U ₃ O ₈	Uranium oxide, also called yellowcake
UMTRA	Uranium Mill Tailings Remedial Action Project
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (PL 95-604)
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
Vitro	Vitro Chemical Company, South Salt Lake, Utah
VTSSC	Vitro Tailings Site Selection Committee; a committee appointed by the Governor of Utah in 1980
WL	Working level (a measure of radon-daughter-product concentration)
WLM	Working-level month (exposure to 1 WL for 170 hours)
X̄	Mean (average value of the variable)
μ	Micro; a prefix meaning one-millionth (10 ⁻⁶)

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INDEX

accidents	
radioactivity involved	5.1.3, 5.1.5
radioactivity not involved	5.14
during transportation	5.1.5
air quality	
impacts on	5.2
present levels	4.1, 4.4
standards	4.4
alternatives	
comparison	3.3.1, 3.3.3
description	3.2
eliminated from consideration	3.2.5
impacts of	3.3, Chapter 5
aquatic biota	
description	4.7.4
impacts on	5.5
archaeological resources	
description	4.11.3
impacts on	5.8
biology; see aquatic biota, plants, wildlife	
cooperative agreement	2.2
costs	Appendix A
cover material	3.2.3, 3.2.4, Appendix A
cultural resources	
places of interest	4.11.3
resources of communities	4.12.5
impacts on	5.8
disposal sites; see site selection	
dust; see air quality	
earthquakes	4.5.4, Appendix H
impacts of	5.3.4
ecology; see aquatic biota, plants, wildlife	
economics	4.1, 4.12.2, 5.11, Appendix I
endangered species	4.7.5, 5.5
energy, use of	5.13, Appendix A
engineering; see alternatives, description	

flooding	4.6.1, Appendix A, 5.3.4
gamma radiation; see radioactivity	
geology	4.5
ground water	
description	4.6.2, Appendix D
impacts on	5.4.2
quality	4.6.2, Appendix D
standards	3.1.1, Appendix D
history	
of sites	4.2
points of interest	4.11.1, 4.11.3
impacts on	5.8
housing	4.12.4, 5.10
impacts	
comparison of	3.3.1
prediction methods	
summary	3.3.3
land use	4.1, 4.9, 5.6, Appendices E,I
conflicts	5.15
plans and policies	4.9
licensing and permits	
NRC	2.2, 3.1.2
meteorology	4.3
see also floods, precipitation, storms, temperature, winds	
mineral resources	4.5.3 5.3.3
mitigation of impacts	3.3.2, 5.19, Appendix A
noise	4.10, 5.7
Nuclear Regulatory Commission (NRC)	
licensing	2.2, 3.1.2
regulations	3.1.2
plants	
aquatic	4.7.4
impacts on	5.5
terrestrial	4.7.3
population	
distributions	4.12.1
impacts	5.9
precipitation	4.3.3
public opinion	4.12.8

radioactivity	
background levels	4.8
health effects of	5.1, Appendix F
pathways	5.1.2, Appendix F
predictions	5.1, Appendix F
radium	
in ground water	4.6.2, 4.8, Appendix D
in soil	4.8, Appendix F
standards	3.1.1
in surface water	4.6.1, 4.8, Appendix D
radon	
in air	4.8
effluent from sites	5.1, Appendix F
standards	3.1.1
railroads	4.12.6, 5.12, Appendix A
rain; see precipitation	
remedial action; see alternatives, UMTRCA, UMTRA Project	
reprocessing	3.2, Appendix C
scenic points of interest	4.11.3, 5.8
seismicity; see earthquakes	
sites	
description	4.1, 4.2
selection	Appendix B
socioeconomics	
description	4.12, Appendix E
impacts on	5.9-5.12
soils	4.5.1, 4.5.2, 5.3, Appendix H
species; see aquatic biota, plants, wildlife	
stabilization in place; see alternatives	
standards	
air quality	4.4
cleanup	3.1.1
disposal	3.1.1
EPA	2.2, 3.1.1
ground water	3.1.1
soil	3.1.1
surface water	3.1.1

storms	4.3.5
surface water	
description	4.6.1, Appendix D
impacts on	5.4.1
quality	4.6.1, Appendix D
standards	3.1.1, Appendix D
surveys, radiological	4.2, 4.8, Appendix F
tailings, description of	4.2
taxes	4.12, 5.11
temperature	4.3.2
transportation	
of contaminated material	3.2, Chapters 4 and 5, Appendix A
of cover material	3.2, Appendix A
networks	4.1, 4.12.6
Uranium Mill Tailings Radiation Control Act (UMTRCA)	2.2, 3.1
Uranium Mill Tailings Remedial Action (UMTRA) Project	3.1
uranium	4.2, 4.6.2, 4.8, Appendix F
vegetation; see plants	
vicinity properties	2.2
Vitro Chemical Company	4.1
weather patterns	4.3
see also meteorology	
wildlife, terrestrial	4.7.3, 5.5
winds	4.3.4
work force	5.9

