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DOE/EA-1080

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Environmental Assessment

Commercial Demonstration of the NOXSO SO_2/NO_x Removal Flue Gas Cleanup System

Clean Coal Technology Program

June 1995

U.S. Department of Energy
Pittsburgh Energy Technology Center

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ACRONYMS AND ABBREVIATIONS

CCT	Clean Coal Technology
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EA	Environmental Assessment
gpm	gallons per minute
gpy	gallons per year
H_2S	hydrogen sulfide
mgd	million gallons per day
MMBtu	million British thermal units
MW	megawatts
MWhr/yr	megawatt hours per year
NDP	NOXSO Demonstration Project
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OCP	Olin Charleston Plant
OSHA	Occupational Safety and Health Administration
OVWB	Ohio Valley water body
PM_{10}	particulate matter 10 microns in diameter or smaller
PON	Program Opportunity Notice
scfh	standard cubic feet per hour
SIP	State Implementation Plan
SO_2	sulfur dioxide
SRU	sulfur recovery unit
tpy	tons per year
WPP	Warrick Power Plant

INTRODUCTION

This environmental assessment (EA) was prepared by the U.S. Department of Energy (DOE) in compliance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality regulations for implementing NEPA as codified in Title 40 of the Code of Federal Regulations, Parts 1500-1508 (40 CFR 1500-1508), and DOE regulations for compliance with NEPA (10 CFR 1021), to evaluate the potential impacts of a proposed demonstration project to be cost-shared by DOE and NOXSO Corporation under the terms of Clean Coal Technology (CCT) Demonstration Program. The project would demonstrate the NOXSO flue gas treatment technology, which is designed to reduce sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from existing coal-fired electric generating units.

The CCT Demonstration Program is a $5 billion program funded jointly by the federal government and industrial participants. Its objective is to introduce advanced, efficient, reliable, and environmentally improved coal utilization technologies to the U.S. energy marketplace, in order to reduce or eliminate economic and environmental barriers to the continued use of coal as an energy source. The program is designed to advance the technical, environmental and economic performance of these technologies to the point at which the private sector can introduce them into the commercial marketplace.

On May 1, 1989, DOE issued a Program Opportunity Notice (PON) for Round III of the CCT Demonstration Program, soliciting proposals to conduct cost-shared CCT projects to demonstrate innovative, energy-efficient clean coal technologies. The proposed technologies were to be capable of (1) achieving significant reductions in the emissions of SO_2 and/or NO_x from existing facilities, and/or (2) providing for future energy needs in an environmentally acceptable manner. The proposed "Commercial Demonstration of the NOXSO SO_2/NO_x Removal Flue Gas Cleanup System" (referred to in this report as the NOXSO Demonstration Project) was selected with twelve other projects from among the 48 proposals received by DOE for CCT Round III.

To comply with the environmental review requirements of NEPA, DOE first prepared a programmatic environmental impact statement, that was issued as a public document in November 1989 (DOE/EIS-0146) for the CCT program. A confidential project-specific environmental review was then prepared for each project proposed to DOE. This EA represents the third level of DOE's NEPA strategy: the preparation and public distribution of NEPA documents for each

project selected for financial assistance under the PON. It contains a site-specific environmental impact analysis of the proposed federal action, and will result in either a Finding of No Significant Impact, or a determination that significant impacts may occur, in which case an Environmental Impact Statement must be prepared. The sources of information for this EA include the technical proposal for the project submitted by NOXSO in response to the CCT Round III PON; discussions with NOXSO and their consultants; discussions with federal, state and local agencies; the April 1995 NOXSO Environmental Information Volume provided to DOE for the project; and visits to the proposed project sites.

1.0 PURPOSE AND NEED FOR THE PROPOSED FEDERAL ACTION

The proposed Federal action is for DOE to provide, through a cooperative agreement with NOXSO Corporation, cost-shared funding support for the design, construction, and operation of an advanced flue gas treatment technology on a fully integrated commercial-scale. The NOXSO flue gas treatment technology is designed to reduce SO_2 and NO_x emissions from existing coal-fired electric generating units. The NOXSO Demonstration Project (NDP) would consist of the following system: the NOXSO process and sulfur recovery unit (SRU), to remove SO_2 and NO_x from flue gas and produce elemental sulfur as a by-product; and the liquid SO_2 plant and air separation unit, to process the elemental sulfur into liquid SO_2. The NOXSO process (with SRU) would be demonstrated on flue gas from Unit 2 of the Alcoa Generating Corporation's Warrick Power Plant (WPP), in Newburgh, Indiana. The elemental sulfur produced at the WPP would be shipped to the Olin Charleston Plant (OCP) in Charleston, Tennessee, for conversion into liquid SO_2. The goals of the proposed NDP include the reduction of WPP Unit 2 SO_2 and NO_x emissions by 94% and 73%, respectively, and waste minimization through the beneficial use of the sulfur by-product.

The NOXSO flue gas treatment technology, if successfully demonstrated in a large-scale commercial operation, would assist utilities in attaining the emission limits specified by the 1990 Clean Air Act Amendments. The Amendments impose stringent controls on emissions of SO_2 and NO_x, the principal precursors to acid rain. This project would also contribute to the objectives of the CCT Program, which encourage the development of advanced, efficient, reliable and environmentally improved coal utilization technologies.

2.0 PROPOSED FEDERAL ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The proposed action is for DOE to provide through a cooperative agreement with NOXSO Corporation cost-shared funding, for design, construction, and commercial-scale operation of the NOXSO flue gas treatment technology and related process equipment, which would reduce SO_2 and NO_x emissions from an existing coal-fired electric generating unit. The NDP component at the WPP would include the NOXSO process, which uses a continuously regenerated sorbent to remove SO_2 and NO_x from flue gas, and the SRU to convert sulfur compounds in the NOXSO process off-gases to elemental sulfur. A liquid SO_2 plant and associated air separation unit would be constructed and operated at the OCP, to convert the elemental sulfur produced at the WPP into liquid SO_2 feedstock for the manufacture of sodium hydrosulfite at Olin Corporation facilities. Figure 2-1 presents an overview of the NDP proposed action at each location.

Construction activities at both locations would begin in Summer 1995 and be completed by mid-1996. Operation of the 2-year demonstration project would begin in Fall 1996. Upon completion of the NDP, the NOXSO process and SRU would be operated commercially by NOXSO Corporation for a period of eight years, and subsequently by Alcoa for an indefinite period of time; the liquid SO_2 plant would be leased by Olin for ten years, at which time ownership would transfer to Olin and the plant would be operated indefinitely.

NOXSO estimates the total project cost at $82.8 million.

2.1.1 NOXSO Demonstration Project Component at Warrick Power Plant

Warrick Power Plant and Warrick Operations

The WPP site consists of 600 acres located on the northern bank of the Ohio River in Newburgh, Indiana, 15 miles east of Evansville, Indiana (Figure 2-2). The WPP is owned by Alcoa and operated by Southern Indiana Gas and Electric Company; it consists of three coal-fired steam electric generating units (Units 1, 2, and 3), each rated at 144 megawatts (MW), and

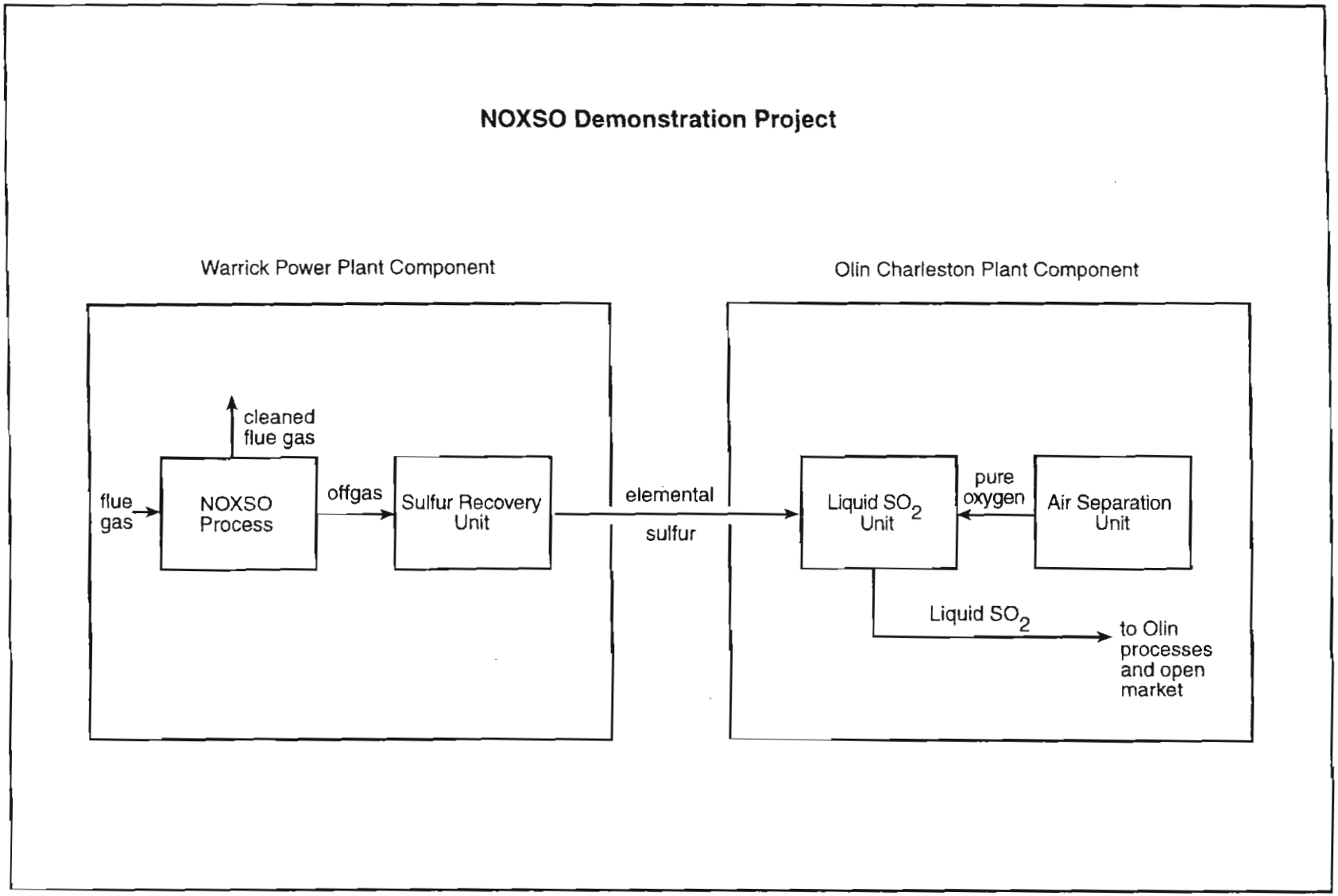
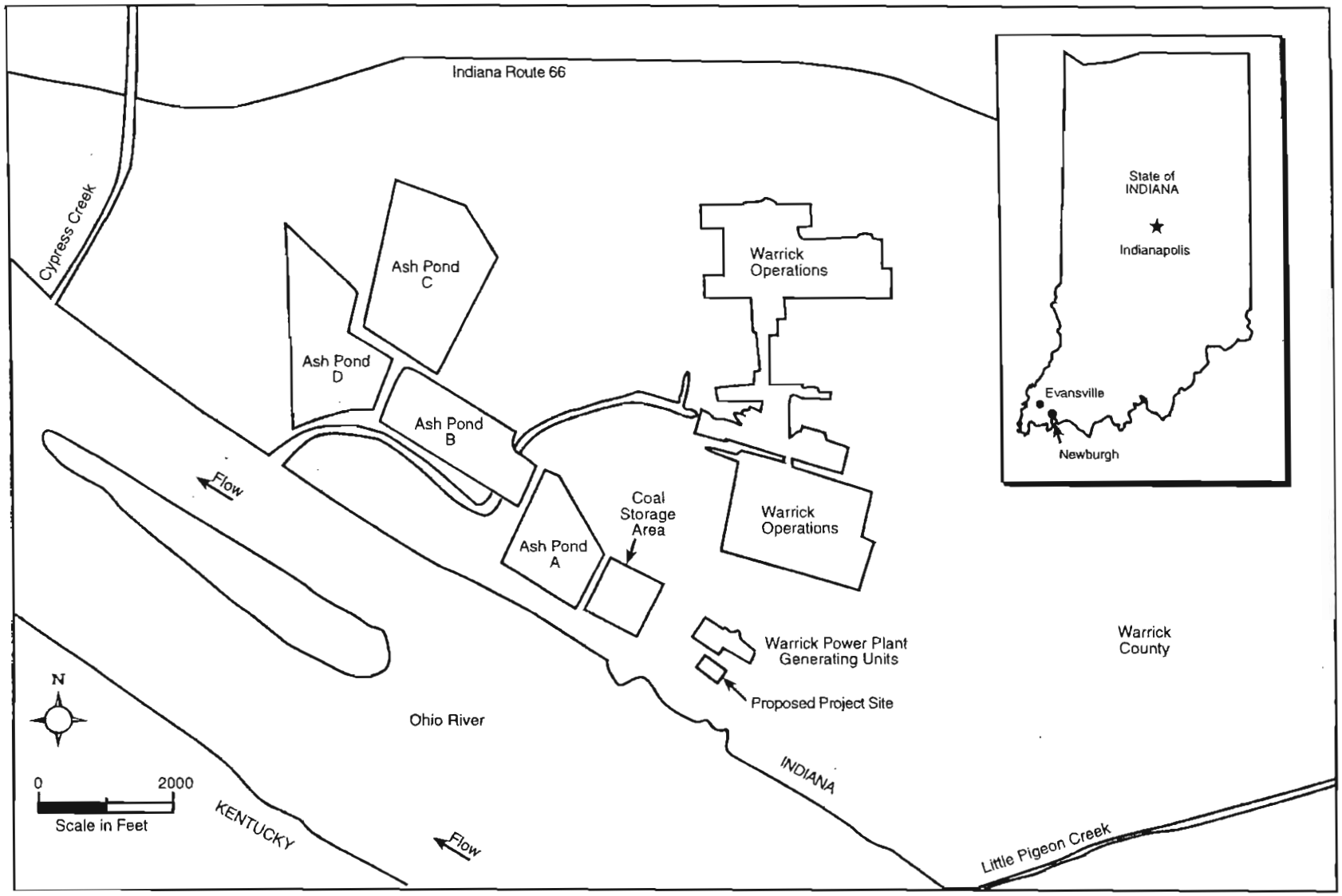


Figure 2-1. NOXSO Demonstration Project Components



Reference: NOXSO, April 1995 (Revised)

Figure 2-2. Warrick Power Plant Site Location - Newburgh, Indiana

Unit 4, rated at 300 MW. The WPP supplies approximately 80% of its generating capacity to the adjacent Warrick Operations aluminum facility, also owned by Alcoa; the remaining 20% flows to the public utility grid.

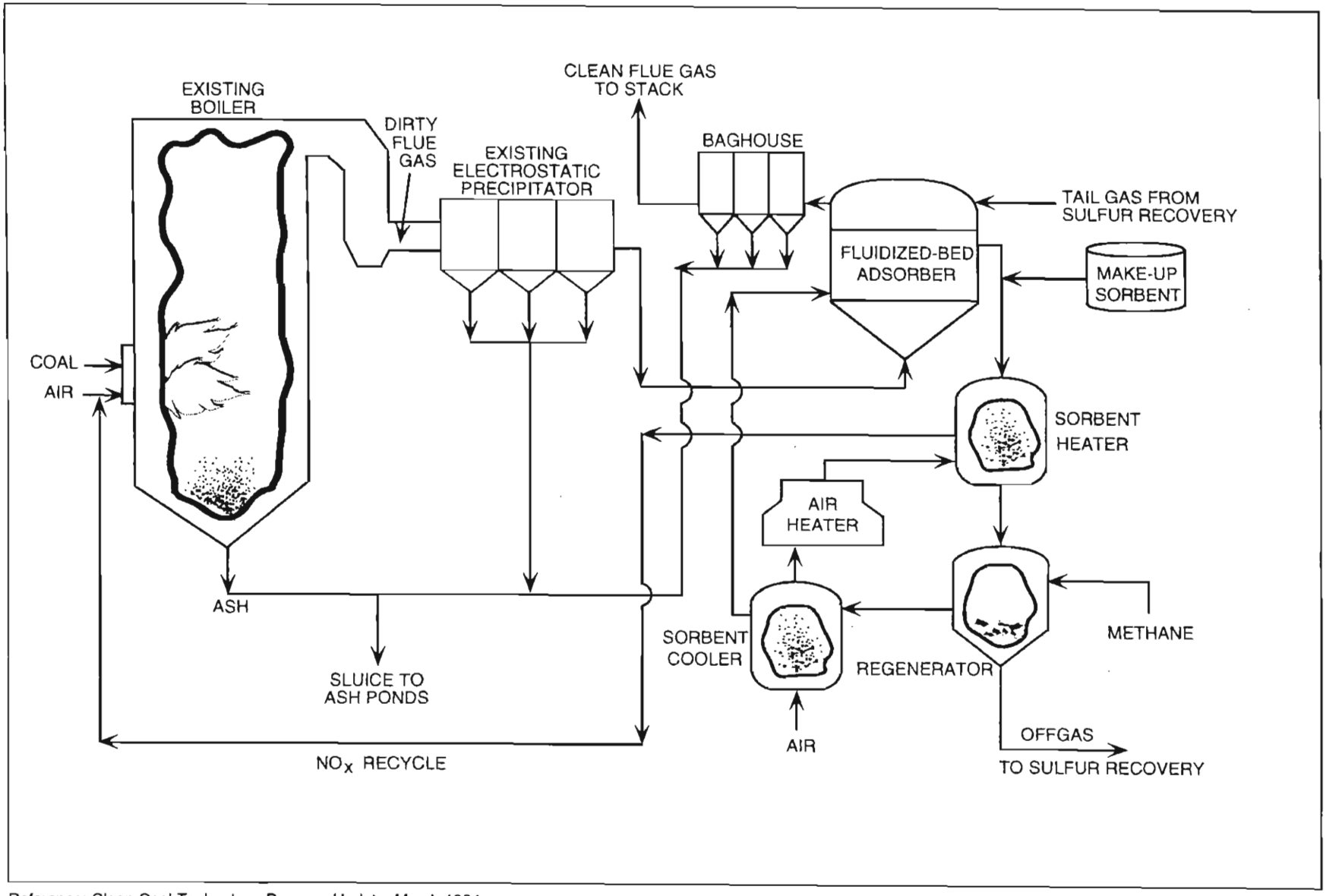
Units 1, 2 and 3 of the WPP are not regulated by the Acid Rain provisions of the Clean Air Act that require SO_2 and NO_x emission reductions, because they do not supply electricity to the public utility grid. Alcoa plans to voluntarily enter the Acid Rain Program of the Clean Air Act under the Opt-In regulation (40 CFR 72), which provides SO_2 emission allowances to non-regulated emission sources that voluntarily reduce SO_2 emissions. Since the NDP would reduce Unit 2 SO_2 emissions by 94%, the SO_2 emission allowances obtained could then be used by Alcoa or sold on the open market to facilities regulated under the Acid Rain Program. The NDP SO_2 emissions reduction would therefore offer tangible benefits to Alcoa under the Opt-In Program.

NOXSO Demonstration Project at the Warrick Power Plant

The proposed project would be the first full-scale demonstration of the NOXSO technology. The NDP at the WPP would consist of the NOXSO process installed on Unit 2 and the SRU. The NOXSO technology has been proven in laboratory and bench-scale applications, and over 6500 hours were logged at the pilot-scale 5 MW Proof of Concept project at the Ohio Edison Toronto Power Station in Toronto, Ohio. The sulfur recovery technology uses the Claus process, a proven technology widely used in the U.S. today.

NOXSO Process Description

The NOXSO flue gas treatment technology is a dry, regenerable process designed to reduce SO_2 and NO_x emissions from existing coal-fired steam electric generating units. The basic process is depicted in Figure 2-3. Flue gas from WPP's Unit 2 after electrostatic precipitation for particulate removal would pass through a NOXSO process unit (called an adsorber) where the gas stream would directly contact the NOXSO sorbent (a high surface area, gamma-alumina bead). The SO_2 and NO_x in the flue gas would be adsorbed onto the sorbent, and the cleaned flue gas would exit the NOXSO process through a baghouse prior to discharge from the existing



Reference: Clean Coal Technology Program Update, March 1994

Figure 2-3. NOXSO SO_2/NO_x Removal Flue Gas Cleanup Process

power plant stacks. The baghouse would remove attrited sorbent (particulate matter resulting from sorbent breakdown), and most of the fly ash resulting from Unit 2 operation.

The sorbent (saturated with SO_2 and NO_x) exiting the NOXSO adsorber would be continuously regenerated by a series of units including a sorbent heater, regenerator, and sorbent cooler. The sorbent heater would remove NO_x from the sorbent and recycle it back to the Unit 2 furnace where it would dissociate to nitrogen and oxygen or would suppress the formation of additional NO_x. In the regenerator, the NOXSO sorbent would be contacted with natural gas and steam, to reduce sulfur compounds on the sorbent to primarily SO_2 and hydrogen sulfide (H_2S). This off-gas stream would exit to the SRU. Finally, the regenerated sorbent would be cooled and returned to the adsorber for reuse.

Sulfur Recovery Unit Description

The SRU would use the Claus process to convert the off-gas stream from the NOXSO sorbent regenerator into elemental sulfur (yielding approximately 16,000 tons of sulfur per year). The Claus process requires a series of process units including a hydrogen reactor, sulfur condenser, and sulfur converter. A brief description follows.

Upon entering the SRU, the off-gas stream is split between the hydrogen reactor and the sulfur condenser. In the hydrogen reactor, SO_2 is hydrogenated to H_2S; this concentrated H_2S stream rejoins the original stream in the sulfur condenser, where heat is removed. The gas would then be compressed, reheated, and passed through the sulfur converter, where H_2S and SO_2 would be reacted in the presence of a catalyst to produce gaseous sulfur. Gaseous sulfur would be removed from the gas stream by another passage through the sulfur condenser, and stored as a liquid sulfur in a steam heated storage tank. The remaining by-product gas stream from the condenser would flow to a tail gas incinerator to oxidize fugitive carbonyl sulfide, carbon bisulfide, and unreacted H_2S. The incinerator off-gas stream would then be recycled back to the NOXSO adsorber, forming a closed loop to eliminate air emissions.

Construction and Operation of the NDP at the WPP

The proposed NDP process units would be constructed adjacent to the existing WPP generating units, in a previously disturbed area within the boundaries of the WPP, as illustrated in Figure 2-4. A rail spur approximately 1500 feet long would also be constructed to load sulfur

directly from the sulfur storage tanks (for rail delivery to Charleston, Tennessee, a distance of approximately 250 miles).

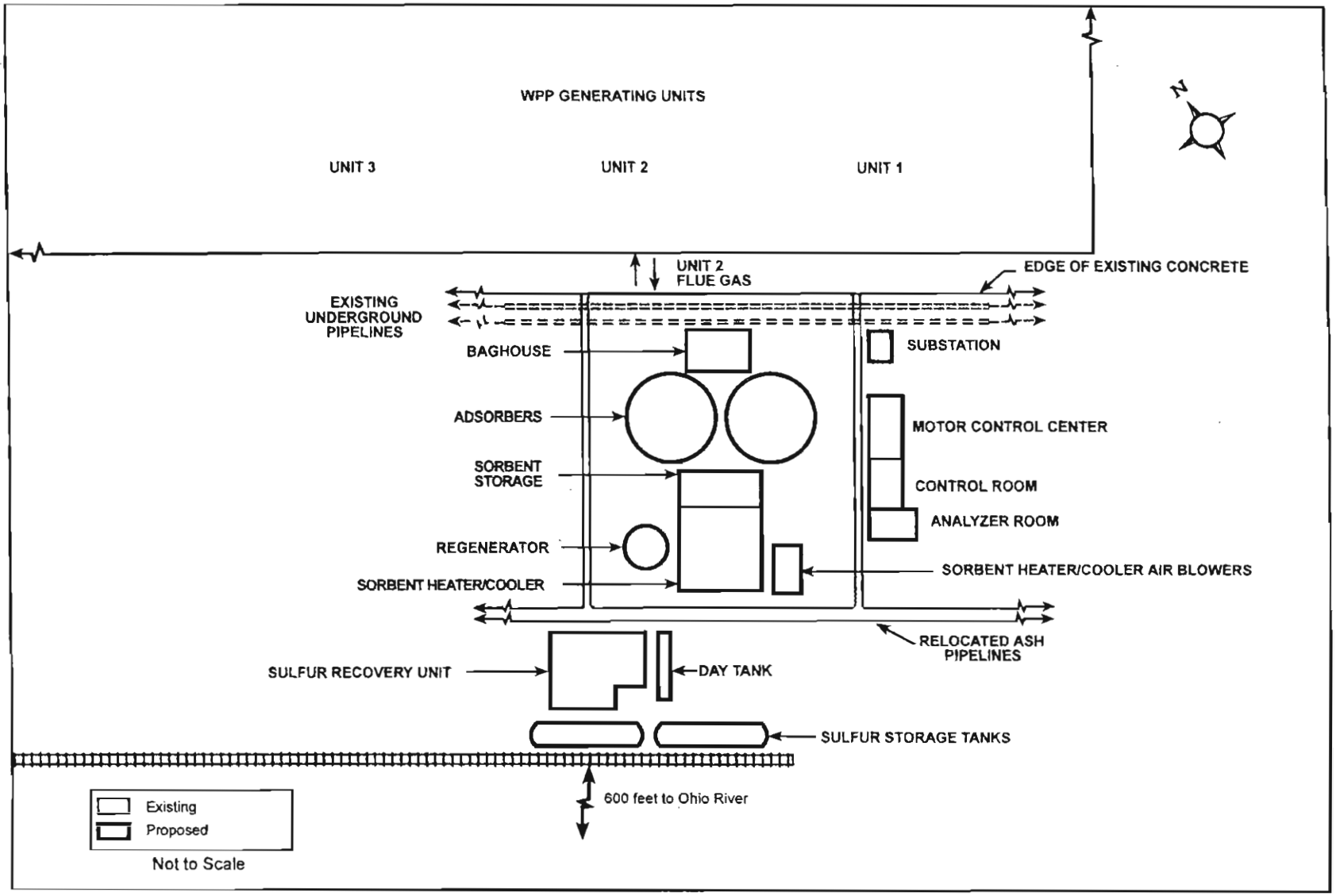
The NOXSO process would be retrofitted to the WPP's 144 MW Unit 2. Currently, all four units at the WPP are fired with coals blended not to exceed the Indiana State Implementation Plan limit of 5.11 pounds (lbs) SO_2 per million British Thermal Units (MMBtu) of heat input. The blend consists of roughly 80% Squaw Creek coal (at 5.8 lbs SO_2/MMBtu) and 20% low-sulfur Appalachian coal. Commencing with the start-up of the NDP, Unit 2 would be fired exclusively with high-sulfur coal.

A summary of the material and energy resources that would be required for operation of the NOXSO process and SRU at the WPP is provided in Table 2-1.

Table 2-1. Resource Requirements for the NDP at WPP

Resource	WPP Unit 2 Requirements		
	Existing	**With NDP**	**Change with NDP**
Coal (tpy)	527,649	527,649	0
Sorbent (tpy)	0	639	639
Water (mgd) surface groundwater	 93.6 0.18	 93.6 0.39	 0 0.21
Steam (pounds per hour)	Data not available	15,000[1]	15,000[1]
Fuel Oil (gpy)	46,612	46,612	0
Natural Gas (scfh)[2]	92.5×10^3	92.6×10^3	116,000
Electrical Power (MWhr/yr)	73,352	94,994	21,642[3]
Labor - operation[4]	180	195	15

[1] Steam would be supplied by the SRU.
[2] Gas used by entire WPP. (Unit 2 uses no natural gas.)
[3] WPP Unit 2 generation would be derated by 2%.
[4] Labor required for all four WPP units.
Reference: NOXSO EIV, April 1995 (Revised).



Reference: NOXSO, April 1995 (Revised)

Figure 2-4. Proposed Project Site at Warrick Power Plant

2.1.2 NOXSO Demonstration Project Component at Olin Charleston Plant

The proposed NDP includes the OCP component, which consists of a liquid SO_2 plant to convert elemental sulfur from the WPP into liquid SO_2 for use in Olin Corporation's existing sodium hydrosulfite manufacturing processes.

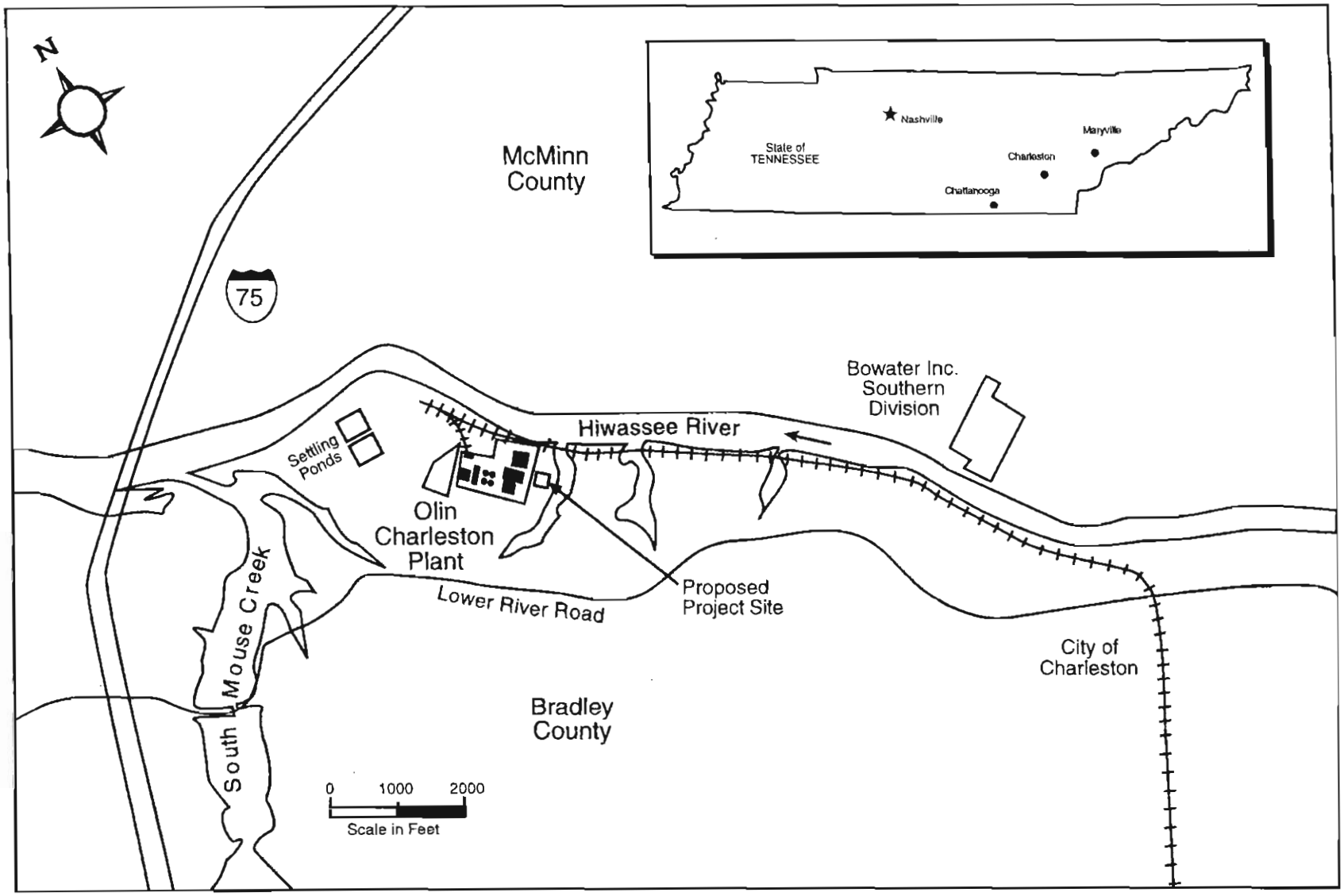
Olin Charleston Plant

The OCP is located on approximately 975 acres on the southern bank of the Hiwassee River, approximately 1.5 miles northwest of Charleston, Tennessee, in the southeastern portion of the state (Figure 2-5). The OCP is a large chemical facility, employing 625 personnel, that produces chlorine, sodium hydroxide, sodium hydrosulfite, hydrochloric acid, and calcium hypochlorite. Infrastructure associated with chemical production includes warehouses, boilers, cooling towers, waste treatment facilities, and other chemical plant facilities.

Liquid SO_2 Plant Description

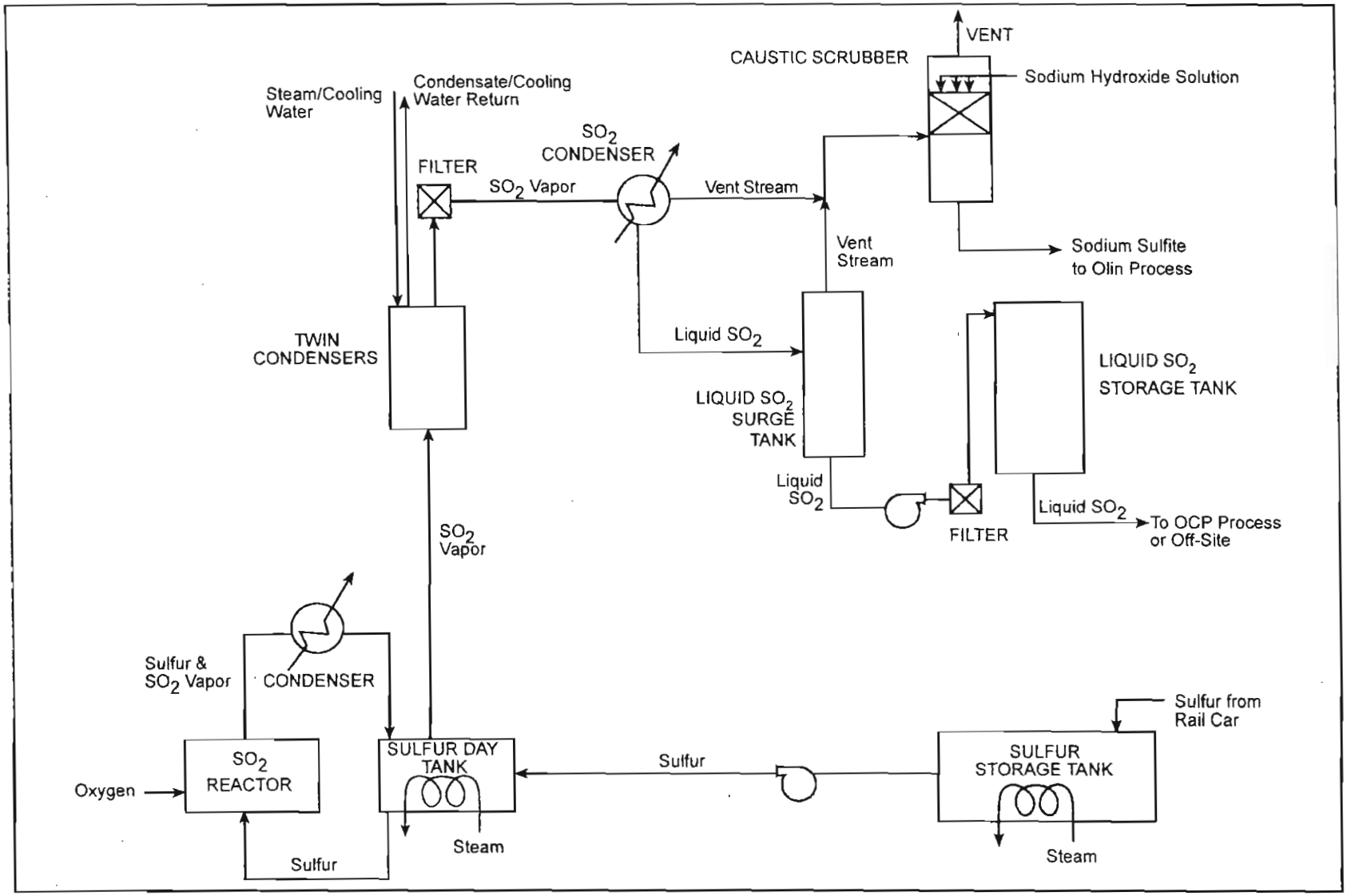
The liquid SO_2 plant would utilize the Calabrian Chemicals liquid SO_2 process to oxidize molten sulfur with pure oxygen into SO_2. The Calabrian process is an advanced liquid SO_2 production process designed for ease of operation and maintenance, while minimizing process waste streams and emissions to the environment. Reliable operation of a 9,000 ton per year (tpy) commercial unit at Calabrian's Texas plant over the last five years has demonstrated and proven the technology. The liquid SO_2 plant would have the operating capacity to produce 45,000 tpy of liquid SO_2. The basic process is depicted in Figure 2-6.

Rail shipments of liquid sulfur would be off-loaded into a 250 ton molten sulfur storage tank from which sulfur would be pumped to a day tank and then fed by gravity into the SO_2 reactor. Within the reactor, the molten sulfur would be heated and oxygen would be injected into the molten sulfur through a submerged sparger. The reaction of sulfur and oxygen would be spontaneous and exothermic (giving off heat) and would produce SO_2 vapor. The SO_2 vapor would be cooled in a condenser and returned to the molten sulfur day tank, where unreacted sulfur would drop out into the tank and be recycled back to the reactor. The SO_2 vapor from the



Reference: Based on Charleston, TN Quadrangle United States Geological Survey Map (Photorevised 1980)

Figure 2-5. Olin Charleston Plant Site Location - Charleston, Tennessee



Reference: NOXSO, April 1995 (Revised)

Figure 2-6. Liquid SO_2 Plant Process

tank would then be further cooled in twin condensers to remove any trace amounts of sulfur. Again, the sulfur would be returned to the sulfur day tank.

The SO_2 vapor would be filtered to remove elemental sulfur and condensed to liquid SO_2 in a cooling water condenser. The liquid SO_2 would flow into the liquid SO_2 surge tank and would pass through another filter to remove residual sulfur before being pumped into a 150 ton storage tank. From the storage tank, the liquid SO_2 would be pumped to an existing feed tank at the OCP for on-site use and to rail cars or trucks for off-site shipment.

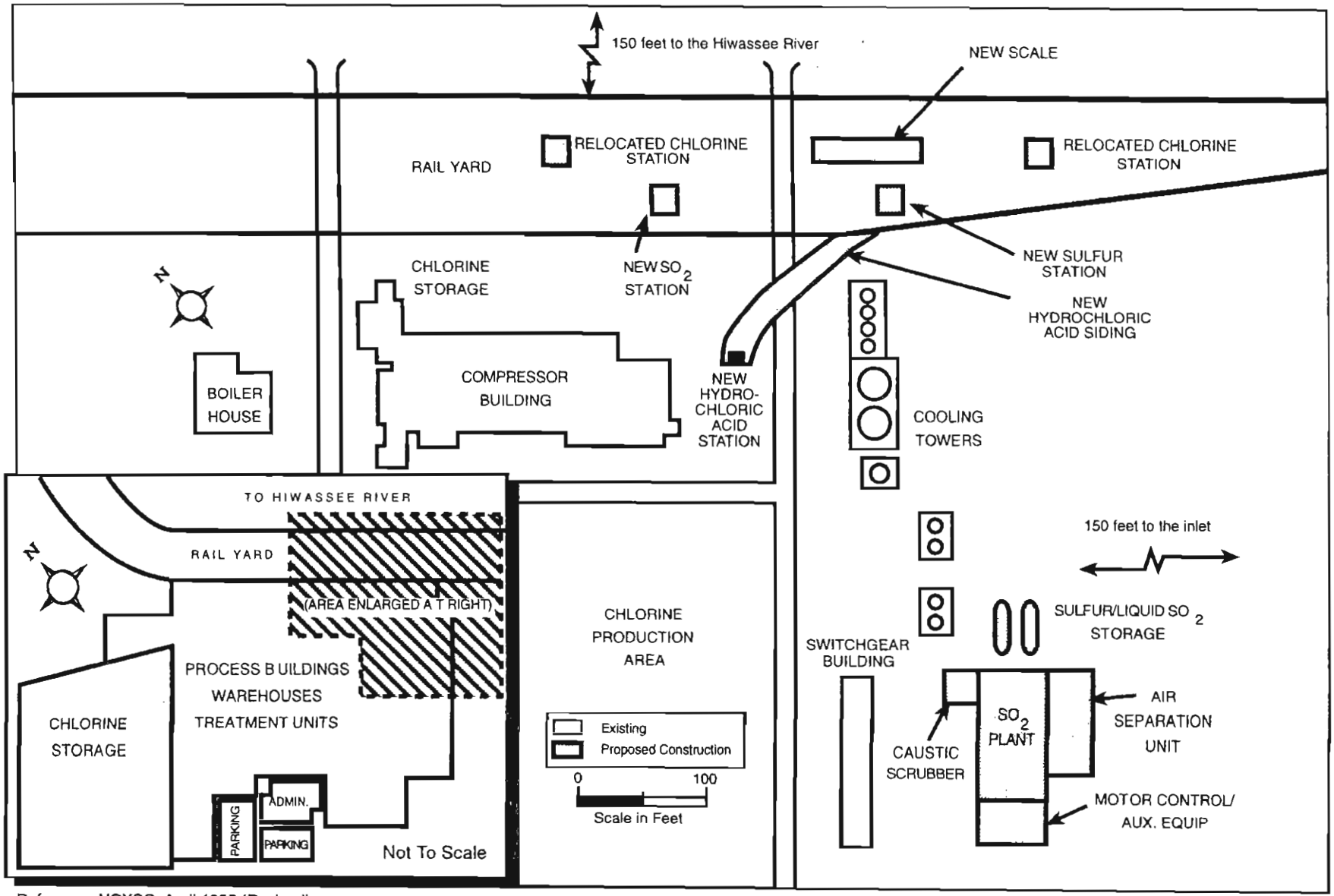
A vent stream from the SO_2 condenser and liquid SO_2 surge tank would contain SO_2 vapor and non-condensibles (trace amounts of nitrogen and argon introduced to the sulfur reactor with the oxygen). The SO_2 vapor would be removed from the vent stream using a caustic scrubber to react available sodium hydroxide with the SO_2 to produce sodium sulfite, which would be used on site.

Air Separation Unit Description

Pure oxygen would be supplied to the liquid SO_2 plant by the air separation unit, which compresses air and uses distillation to separate the air into its components. In the process, atmospheric air would first pass through a filter to remove entrained particulate. The air would then be compressed, cooled, and pass through a separator and a molecular sieve where moisture and carbon dioxide would be removed. The air would be further filtered and cooled and separated in a distillation column, based upon the difference in boiling points between nitrogen and oxygen. Oxygen withdrawn from the column would pass through an adsorber to remove hydrocarbons and would be piped to the liquid SO_2 plant. Nitrogen recovered from the distillation column and cooling water would both be used as cooling agents; no refrigerants would be required.

Construction and Operation of the NDP at the OCP

The liquid SO_2 plant (including storage tanks and above ground piping) would be constructed on OCP property in a previously disturbed and filled area located just east of the existing switchgear building (Figure 2-7). In addition to new SO_2 and sulfur stations, associated construction in the rail yard would include a new hydrochloric acid siding and station, relocated chlorine stations and a new scale, to provide sufficient rail yard area for the NDP.



Reference: NOXSO, April 1995 (Revised)

Figure 2-7. Proposed Project Site at Olin Charleston Plant

The liquid SO_2 plant would process all of the elemental sulfur produced from the NDP, approximately 16,000 tpy. Additional sulfur (about 7,000 tpy) would be purchased on the open market to produce 45,000 tpy of liquid SO_2 at the OCP. Approximately 20,000 tpy of the liquid SO_2 would be used as feedstock at the OCP. Another 12,000 tpy of liquid SO_2 would be shipped by rail to an Olin facility in Augusta, Georgia; the remaining 13,000 tpy would be sold on the open market.

Material and energy resources required for operation of the liquid SO_2 plant are summarized in Table 2-2.

Table 2-2. Resource Requirements for the NDP at OCP

Resource	OCP Requirements		
	Existing	With NDP	Change with NDP
Sulfur (tpy)	0	23,100[1]	23,100
Liquid SO_2 (tpy)	20,000	0[2]	-20,000
Oxygen (tpy)	0	22,950[3]	22,950
Water (mgd)	4.6	4.6	0.03
Caustic (tpy)[4]	Data not available	Data not available	5,712
Electrical Power (MWhr/yr)	1.1×10^6	1.1×10^6	9,636
Fuel Oil (gpy)	230,000	0	0
Labor - operation	625	629	4

[1] Sulfur supplied from NDP at WPP (16,000 tpy) and from the open market (7,000 tpy).
[2] Liquid SO_2 would be produced on-site from the liquid SO_2 plant. OCP usage rate would remain the same.
[3] Oxygen required by the liquid SO_2 plant would be supplied by the air separation unit.
[4] Caustic is produced on-site at the OCP in large quantities (286,000 tpy).
Reference: NOXSO EIV, April 1995 (Revised).

2.2 ALTERNATIVES ELIMINATED FROM CONSIDERATION

Under Round III of the CCT Program, DOE solicited proposals to conduct cost-shared projects to demonstrate innovative, energy efficient technologies for possible commercialization in the 1990's. The selection criteria included the reduction of emissions from existing facilities and/or environmentally achievable benefits for future energy needs. Other than compliance with these basic objectives of the CCT program, and the use of U.S. coal and demonstration sites, the prospective offerors were not constrained with regard to technology or site. Those proposals suitable for comprehensive evaluation received a confidential pre-selection environmental review, based on the information provided in the proposal. This review summarized the strengths and weaknesses of the project relative to the environmental evaluation criteria including: a discussion of alternative sites and technologies reasonably available to the proposer, a brief discussion of the potential environmental impacts of each proposal, necessary mitigative measures and, to the extent known, a list of permits and licenses to be obtained in implementing the proposal.

Given the nature of the CCT selection process, DOE is limited to accepting or rejecting the overall demonstration project as proposed by the participant, including both the technology and site designated by the offeror. Therefore, the only technology and sites analyzed in this EA are those proposed by the participant. Alternative sites were considered by the offeror, and these sites are briefly discussed in Section 2.4.

2.3 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, where DOE would not provide cost-shared support, the NOXSO flue gas treatment technology would probably not be installed at WPP Unit 2. Construction of the liquid SO_2 plant at the OCP would also be unlikely. Alcoa may still elect to enter the Clean Air Act Opt-In Program using other emission reduction techniques. Without DOE funding, the NDP would likely be cancelled, which would not contribute to the goals of the CCT program. NOXSO's advanced flue gas treatment technology would remain untested at commercial-scale, and it is unlikely that utilities would view this technology as an alternative method for attaining Clean Air Act requirements for SO_2 and NO_x due to lack of data regarding feasibility, effectiveness, and environmental benefits.

2.4 ALTERNATIVE SITES

Alternative sites were considered by NOXSO for the NDP prior to the selection of the WPP and OCP sites. Screening criteria included: sulfur content of existing coal burned at a utility, flue gas stream capacity, related project experience of the host site, local governmental support, sufficient space for the proposed installation, local demand for the sulfur or SO_2 by-product, availability of energy and material resources, contractual agreements, and potential for long-term operation of the NOXSO technology at the selected site upon conclusion of the NDP.

The original host site for the NDP was the Ohio Edison Niles Station, Unit 1, in Niles, Ohio. However, the parties involved were unable to finalize contractual arrangements. Based on the above criteria, the WPP site was deemed the most suitable for demonstration of the NOXSO technology. Similarly, at least one other site was evaluated for the liquid SO_2 plant location at an industrial location in South Carolina, and the OCP was selected based on an economic evaluation.

Impacts at the Ohio and South Carolina sites would be similar to those described in this EA for the two selected project locations.

3.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AT WARRICK POWER PLANT AND THE NO-ACTION ALTERNATIVE

3.1 AIR RESOURCES

The Evansville, Indiana area has a temperate continental climate with average monthly temperatures ranging from 33°F in January to 78.7°F in July. The mean annual precipitation is 42.5 inches, including an average snowfall of 13.8 inches. The wind blows predominantly from the south-southwesterly direction.

The WPP site is located in Warrick County, Indiana which is designated as attainment or unclassifiable for the National Ambient Air Quality Standards for SO_2, NO_x, Particulate Matter 10 microns or smaller in diameter (PM_{10}), carbon monoxide and ozone. Existing air quality is considered to be acceptable under this designation. Other sources of air emissions within the immediate vicinity of the WPP include Warrick Operations and the 415 MW coal-fired Culley Power Plant.

Fugitive dust emissions from construction activities would result from general construction work and would be minimized by employing standard industry practices such as tarping, use of water sprays, etc. These emissions, along with exhaust emissions from construction vehicles and equipment, would occur on a short-term and intermittent basis.

With the NDP, Unit 2 SO_2 and NO_x emissions would be reduced by 94% and 73%, respectively. Unit 2 emissions under base case (defined as operating at the maximum of permit limitations) and with NDP operation are shown in Table 3-1. Particulate emissions from Unit 2 would also be reduced by the baghouse installed downstream of the NOXSO process. The proposed baghouse would capture most attrited sorbent particles as well as most fly ash not captured by the existing electrostatic precipitator, therefore reducing total suspended particulate and PM_{10} emissions from Unit 2 by 88% and 83%, respectively. Unit 2 particulate emissions, including fly ash and attrited sorbent, are shown in Table 3-2.

Table 3-1. NDP SO_2 and NO_x Emission Reductions at WPP

Pollutants	Unit 2 Emissions		
	Base Case[1], tpy	With NDP[2], tpy	Reduction, %
SO_2	27,320	1,669	94
NO_x	5,381	1,466	73

[1] Based on operating permit limitations.
[2] Based on combustion of 100% Squaw Creek coal in Unit 2.
Reference: NOXSO April 1995 (Revised).

Table 3-2. NDP Particulate Emission Reductions at WPP

Particulate Type	Unit 2 Emissions				
	Base Case[1], tpy	With NDP[2], tpy			Reduction, %
	Fly Ash	Fly Ash	Attrited Sorbent	Total	
Total	295.3	17.4	19.2	36.6	88
PM_{10}	197.9	16.8	17.6	34.4	83

[1] Based on operating permit limitations.
[2] Based on combustion of 100% Squaw Creek coal in Unit 2.
Reference: NOXSO April 1995 (Revised).

Any carbon monoxide produced by the combustion of natural gas in the NOXSO process and SRU would be oxidized to carbon dioxide as it passes over the surface area of the NOXSO sorbent. Overall, the NDP would increase Unit 2 carbon dioxide emissions by about 4%. Natural gas combustion in the NOXSO process would generate minimal NO_x emissions.

Limited fugitive emissions during operation of the NDP would result primarily from sorbent unloading from a tank truck to an on-site storage bin. Sorbent would be loaded to the bin via a pneumatic conveyer; fugitive emissions would be minimized by use of a bin filter with a removal efficiency of nearly 100% for particles larger than 10 microns. Odors due to fugitive sulfur emissions are not expected.

A vapor plume from the WPP stacks is occasionally visible, primarily during the winter months. The NDP would increase the water content of the flue gas from stacks 1 and 2 by a minor amount, which could marginally increase the presence of a visible plume during winter, late fall and early spring.

The overall effect of the NDP would be positive due to large reductions of SO_2, NO_x, total suspended particulate, and PM_{10} from Unit 2 of the WPP. The change in plume rise and buoyancy associated with Unit 2 would be negligible. The Indiana Department of Environmental Management would be notified in writing of changes at the WPP site due to NOXSO process installation, and the NOXSO process would be formally incorporated into the WPP's existing air permit #CP173-2087. The impacts of attrited sorbent being discharged in the cleaned flue gas are discussed in Section 3.11.

3.2 WATER RESOURCES

The Ohio River is located approximately 600 feet south of the proposed project site. The river provides a source of water for the WPP and also receives effluent from the plant. The water quality of the Ohio River is designated by the Ohio River Valley Water Sanitation Commission. The WPP is located at Ohio River mile 774 and within Ohio Valley water body (OVWB) 27, immediately upstream of OVWB 28. Designated uses for OVWB 27 include public and industrial water supply, full-body recreational contact, warm water aquatic habitat and fish consumption. When the water quality of a water body is not high enough for its designated uses, the use is considered "partially supported" or "not supported". The OVWB 27 is partially supported for all designated uses; the OVWB 28 is partially supported for all uses except for recreational use, which is not supported. The primary sources contributing to the partially and not supported status designations are nonpoint sources, mostly from agriculture.

The WPP is classified as a high capacity surface water and groundwater user by the Indiana Department of Natural Resources. In 1993, the WPP diverted an average of 444 million gallons per day (mgd) from the Ohio River, primarily for once-through cooling water and ash sluicing. Except for evaporative losses, all of this water was returned to the river.

In addition, the plant uses groundwater from six on-site deep-water wells. Approximately 6 mgd (of the combined 17 mgd capacity) is pumped from these wells and treated for use as

potable and process water by the WPP and Warrick Operations. The NDP would require an additional 0.21 mgd for various process operations. This water would be supplied from the existing groundwater wells; no surface water from the Ohio River would be used. Water would exit the NOXSO process as wastewater, as discharge from the WPP stacks, or as steam returned for use in the WPP.

Both the WPP and Warrick Operations operate under a single National Pollutant Discharge Elimination System (NPDES) permit (No. IN0001155). The WPP has five permitted outfalls. The combined average daily flow for these outfalls ranges from 315 to 465 mgd. The NDP would generate a total of approximately 5,800 gallons per day of wastewater from condensate and boiler blowdown from the SRU. Wastewater from the SRU would be combined with the WPP boiler blowdown wastewater, monitored, treated and discharged in accordance with the NPDES permit discharge limitations for Outfall 103. Outfall 103 currently discharges approximately 9.22 mgd of Warrick Operations process water, cooling water, treated water and storm water. Thermal impacts from the NDP should be negligible.

Currently, the WPP manages about 217,000 tpy of fly ash and bottom ash in the NPDES permitted ash ponds. Solids settling occurs in the ponds, and effluent from the ash ponds is treated for pH adjustment prior to discharge. Operation of the NDP would result in additional ash pond waste of approximately 620 tpy of attrited sorbent and 278 tpy of fly ash captured in the baghouse. This increase from the NDP would be approximately 0.4% of the existing ash waste. The fly ash and attrited sorbent from Unit 2 would be captured and sluiced as a mixture of ash and sorbent. Because the chemical composition of the ash/sorbent mixture is very similar to that of ash currently generated at the plant (Section 3.6), the combined ash/sorbent mixture is virtually indistinguishable chemically from the bottom and fly ash mixture currently sent to the ash ponds. Therefore, the quality (and quantity) of the discharge water from the ash ponds would remain nearly identical to current WPP operating conditions.

Stormwater run-off from the NDP area would be collected in the existing stormwater collection system and treated under current practices. Storm sewers in the vicinity of the project would adequately handle the slight increase in volume from the NDP.

Construction of the NDP would require limited supplies of water on a short-term intermittent basis. Typical construction practices, such as berming, silt fencing and wetting, would be used to control soil erosion and fugitive dust to minimize impacts on water resources.

Operation of the NDP may require modification to the existing NPDES permit and would be coordinated with the Indiana Water Pollution Control Board.

3.3 LAND USE

The WPP is located on the higher, northern bank on the Indiana side of the Ohio River. The area around the WPP consists of flat rolling terrain interspersed with hilly areas. Land uses in the WPP region include industry, farming, and coal mining.

The NDP equipment would occupy a currently unused, unvegetated, previously disturbed 35,000 square foot area south of WPP Unit 2, which has been filled with 30-40 feet of natural soils. Construction activities would occur completely within the plant boundaries on less than 1% of the total area of the industrial plant. Construction would require rerouting of underground utilities and demolition of a temporary storage building but would not disturb current WPP operations or impact any vegetation. Demolition of the NDP would not be anticipated as the unit would be operated commercially at the WPP after the demonstration project. The NDP would not affect prime or unique farmlands located within the vicinity of the WPP.

3.4 ECOLOGY AND BIODIVERSITY

Since construction and operation activities for the NDP would occur exclusively within an unvegetated area, no impacts on vegetation, wildlife, or habitats would be expected. Ecological impacts from the NDP associated with air emissions, wastewater discharge, and waste generation would be minimal and are discussed in other sections of this EA. DOE has been advised by the U.S. Fish and Wildlife Service, in a letter dated March 6, 1995, that the proposed project at the WPP would have no adverse effect on any Federally endangered species or habitat (Appendix).

Biodiversity is an important aspect of environmental protection. This principle places value on the diversity of genes, species, and ecosystems and holds that the loss of biological diversity is potentially harmful to our ecological and economic systems. Based on the preceding discussion, NDP impacts on biodiversity would be negligible.

3.5 FLOODPLAINS AND WETLANDS

The WPP generating units and proposed NDP site fall within an area of minimal flooding (outside the 100-year floodplain) based upon the latest available Federal Emergency Management Agency 1982 Flood Hazard Boundary Map. The existing ash ponds to the west of the WPP fall within the 100-year flood zone area; however, a 1991 survey established that all dikes around the ash disposal ponds are above the 100-year flood elevation.

No wetlands would be disturbed. Wetlands on the WPP and Warrick Operations aluminum facility were assessed by the Army Corps of Engineers in 1980. At that time, a Section 404 permit was issued to allow the construction of Ash Pond D in a jurisdictional wetland. In conjunction with issuance of the permit, the Army Corps of Engineers confirmed that no wetlands, other than those permitted, exist on the WPP and Warrick Operations property. This confirmation further states that "any future use by Alcoa of any real property at the facilities shall not require a permit application as a wetland pursuant to Section 404 or the 404 Regulations" (NOXSO April 1995, Revised).

3.6 WASTE MANAGEMENT AND POLLUTION PREVENTION

Waste Management

Currently, the WPP disposes of approximately 217,000 tpy of fly ash and bottom ash in the NPDES-permitted ash pond system on-site. Approximately 900 tpy of new waste consisting of attrited sorbent and fly ash would be combined with the 217,000 tpy of fly ash and bottom ash currently disposed at the WPP, for an overall increase of 0.4 %. Table 3-3 shows the chemical composition of Squaw Creek coal bottom and fly ash, attrited sorbent, and the ash/sorbent mixture which would be sent to the ash ponds. Because the chemical species in the spent sorbent are similar to those in the ash, the ash/sorbent mixture generated from the NDP would be virtually indistinguishable from that of the existing ash generated at the WPP. No modification of existing permits to solid waste disposal would be required.

Table 3-3. Percentage Composition of Ash and Sorbent Wastes

Component	Bottom and Fly Ash	Attrited Sorbent	Ash and Sorbent
Silicon as SiO_2	44.49	6.00	44.38
Aluminum as Al_2O_3	18.96	83.60	19.15
Iron as Fe_2O_3	23.32	0.00	23.25
Calcium as CaO	7.11	0.00	7.09
Magnesium as MgO	0.81	0.00	0.81
Sodium as Na_2O	0.48	6.70	0.50
Potassium as K_2O	2.02	0.00	2.01
Titanium as TiO_2	1.01	0.00	1.01
Phosphorus as P_2O_5	0.36	0.00	0.36
Sulfate as SO_3	1.36	3.70	1.37
Manganese as MnO	0.08	0.00	0.08

Note: Ash composition based on Squaw Creek coal.
Reference: NOXSO April 1995 (Revised).

Ash handling practices during operation of the NDP would remain the same; no noticeable impacts to the ash ponds from the ash/sorbent mixture would be anticipated. The Indiana Department of Environmental Management would be notified in writing of the disposal of attrited sorbent in the ash ponds.

Other solid wastes from the NDP would be generated from operation of the SRU; these would include spent sulfur converter catalyst, spent hydrogenation catalyst, and fouled heat transfer fluid. The sulfur converter catalyst (about eight tons total) would be generated after approximately four years of NDP operation. The catalyst would be a non-hazardous waste and disposed of accordingly. The hydrogenation catalyst (about three tons), with a lifetime of 2-3 years, would be considered a hazardous waste and would be sent to a catalyst reclaimer or an approved hazardous waste disposal facility. The fouled heat transfer fluid would be a hazardous waste and would either be returned to the supplier under a fluid credit program or sent to a permitted incinerator facility for ultimate disposal. Both of the hazardous wastes would be disposed in compliance with existing regulations.

Construction of the NDP would generate construction-related wastes, which would be properly classified as either non-hazardous or hazardous and transported to permitted off-site facilities for disposal.

Pollution Prevention

Pollution prevention focuses on reducing the amount and/or toxicity of wastes generated by industrial processes.

The proposed project would incorporate several pollution prevention measures. The NOXSO process would remove SO_2 and NO_x from flue gas without transfer of these pollutants to other media such as water or solid waste. The SO_2 would be converted to elemental sulfur, then to liquid SO_2, and used as feedstock for a chemical processing plant. The NO_x would be recycled back to the boiler where it would dissociate into nitrogen and oxygen or suppress the formation of additional NO_x.

The sorbent used in the NOXSO process is a non-toxic, non-hazardous material. It would be continuously regenerated and reused. Another pollution prevention technique inherent in the design of the proposed project is the recovery and use of waste heat.

3.7 CULTURAL AND HISTORIC RESOURCES

According to the Indiana Division of Historic Preservation and Archaeology, there are archaeological and historic resources as well as Native American sites in the general vicinity of the WPP; however, there are none known to exist at the site for the proposed NDP. In a letter to DOE, dated March 14, 1995, the State Historic Preservation Officer concluded the project would have no impact on archaeological or historic resources (Appendix). The NDP would not impact any Native American resources. The Federal government does not recognize any Native American tribes in Indiana, and the State of Indiana does not give official designation to Native American tribes.

Indiana State Route 66, which runs east/west approximately 1 mile north of the WPP, is classified as a scenic route. Because the proposed NDP would be located south of the WPP boilers, the NDP units would not be visible from State Route 66, and no impact on the scenic route would be anticipated.

3.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The NDP construction operations would occur over a 12 month period and require approximately 160 workers. This would create short-term employment for the local and regional labor force. Operation of the NDP would require approximately 12 engineering and operations personnel.

Environmental equity (also known as environmental justice) is a relatively new concept developed to ensure that low income and minorities are not exposed to a disproportionate share of pollution and environmental impacts from industrialized society. This proposed project is expected to have no disproportionate negative impact on environmental equity. The NDP would take place at an existing, large industrial facility and overall impacts would be positive.

3.9 TRANSPORTATION

Indiana State Route 66 is the major thoroughfare for vehicles entering and leaving the power plant. On a weekly basis, the WPP currently receives about 500 coal truck deliveries and 150 commercial and package deliveries, and generates 1200 passenger vehicle round trips. Short-term impacts from construction activities would result in an increase in truck deliveries by 19% and an increase in passenger car traffic by up to 70% during peak periods of construction. Previous construction/maintenance projects at the WPP employing a comparable number of workers have resulted in minimal traffic impacts.

During operation of the NDP, sorbent deliveries would be approximately 1 truck load per week and passenger car traffic would increase by 5% over existing conditions. The WPP currently receives about 325 rail car deliveries per week. An additional 3 rail cars per week would be required to ship the elemental sulfur produced from the SRU to the liquid SO_2 plant at the OCP in Tennessee (an increase in rail traffic of less than 1%).

3.10 NOISE

The WPP is located in a rural industrial area and generates typical power plant ambient noise levels. During NDP construction activities, a small increase in noise levels would occur.

Pile driving would be intermittent and employee noise exposure would be controlled to conform with Occupational Safety and Health Administration requirements. As the closest residence is located approximately 1.5 miles from the site, no adverse impacts on the surrounding community would result from short-term construction activities.

Noise from operation of the NDP would primarily result from forced draft fans and would produce a broad band noise spectrum. Proper hearing protection would be used and a hearing conservation program would be implemented for workers. Due to the location of the NDP within an operating power plant facility, any incremental noise generation resulting from the NDP would not be discernible to the community, and there would be no adverse impacts.

3.11 HEALTH AND SAFETY

Potential health and safety impacts to on-site workers and the surrounding community resulting from construction and operation of the NDP would be minimized through use of standard industrial practices. Prior to construction, an in-depth process hazard review would be performed to identify potential hazards, and to incorporate safety engineering design features into the system (including seismic design criteria). In addition, for both construction and operation activities, safety programs would be written and implemented to reduce the risk of accidents. Written hazard communication programs would be established to inform workers of potentially hazardous chemicals. On-going training of personnel would further reduce the risk of accidents and exposure to hazardous substances. Federal regulations would serve as the foundation for the site's health and safety practices.

Hazardous Substances

Specific health and safety issues from the NDP are related primarily to the presence of methane (in the NOXSO regenerator) and H_2S. Safety design features would be incorporated into the process units to prevent fire and explosion hazards; these would be based on American Petroleum Institute refinery codes and other industry standards, where applicable. To protect against potential hazards, an H_2S leak detection system consisting of area monitors and alarms would be used to alert on-site workers. Safety relief valves and process shut-down systems would divert and eliminate the source of a release should one occur. These safety systems would

protect both on-site workers and the surrounding community. In the unlikely event of a release which might affect the community, the local emergency planning committee and other appropriate authorities would be notified. Because of the low quantities of hazardous substances associated with the NDP, the project would not be subject to regulations for facilities containing large quantities of hazardous materials.

The NDP process units are similar to other processes which routinely operate nationwide. It is extremely unlikely that substantial quantities of hazardous substances would be released due to process or equipment failure. Appropriate safeguards would be implemented throughout the project to provide a level of environmental protection consistent with responsible industry standards.

Sorbent

As discussed previously in Sections 3.2 and 3.6, no noticeable impacts would be expected from disposal of attrited sorbent in the on-site ash ponds. Approximately 19 tpy of attrited sorbent would be discharged to the atmosphere in the cleaned flue gas. Due to the presence of similar chemical species in ash and sorbent (Table 3-3), and the overall decrease in Unit 2 PM_{10} emissions from 198 tpy to 34 tpy, there would be no impacts on community health and safety from sorbent use in the NDP. Stack emissions of each chemical constituent listed in Table 3-3 would decrease as a result of the NDP installation on Unit 2 (NOXSO April 1995, Revised).

3.12 ENERGY AND MATERIAL RESOURCES

In addition to construction materials, operation of the NDP would require the resources shown previously in Table 2-1. Coal use would remain unchanged; natural gas needs would be met by the existing on-site gas line. Groundwater use would increase by 0.21 mgd which can be readily supplied by the existing well system. Electrical power requirements for the NDP would be an estimated 2.5 MW, which would derate the net electrical generation from Unit 2 by 2%. No adverse effects would be expected from the project's resource requirements.

3.13 LONG-TERM AND CUMULATIVE IMPACTS

The NOXSO process and the SRU would continue to operate at the WPP after completion of the NDP. Long-term environmental impacts are expected to be similar to those described for the NDP in this EA. As discussed previously, a positive impact is expected from the NDP due to reduced emissions of SO_2, NO_x and particulates.

There are no known large-scale projects proposed for the Warrick County, Indiana area that, in conjunction with the NDP, would produce cumulative adverse effects.

3.14 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, whereby DOE would not provide cost-shared funding support, it is expected that the NDP would be cancelled. Environmental conditions at the WPP would remain the same, and reductions in SO_2, NO_x and particulates from Unit 2 would not be achieved. In the unlikely event the NDP would proceed without DOE participation, the anticipated environmental impacts would be the same as described in this EA.

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AT THE OLIN CHARLESTON PLANT AND THE NO-ACTION ALTERNATIVE

4.1 AIR RESOURCES

The Charleston, Tennessee area has a moderate climate characterized by cool winters and quite warm summers with average monthly temperatures ranging from 41° F in January to 79° F in July. The mean annual precipitation is 52.2 inches, including an average snowfall of 4.4 inches. The wind blows predominantly from the south.

The OCP is located in Bradley County, Tennessee, which is designated as attainment for the National Ambient Air Quality Standards for SO_2, NO_X, PM_{10}, carbon monoxide and ozone. There is no regional designation for lead. McMinn County, across the Hiwassee River from the OCP, has the same attainment status designation as Bradley County.

Current OCP air emissions are estimated at 75 tpy of NO_X, 21 tpy of particulate matter, and <5 tpy of SO_2 (based on 1993 emissions). The nearest industrial facility, the Bowater Incorporated Southern Division (Bowater) pulp and paper plant, is located across the river and to the east approximately 1 mile from the OCP. The Bowater plant produces pulp and paper; substantial quantities of SO_2 are typically emitted by pulp and paper manufacturers.

Construction activities for the NDP would result in fugitive emissions from general construction work as well as exhaust emissions from construction vehicles and equipment. These emissions would occur on a short-term and intermittent basis. Fugitive emissions would be minimized by employing standard industry practices such as tarping, use of water sprays, etc.

The only process source of air emissions from the liquid SO_2 plant would result from the plant vent stream, which would be treated by a caustic scrubber installed as part of the process unit. Based on operating experiences from a similar liquid SO_2 plant, the scrubber would remove nearly 100% of the vent stream SO_2. Emissions from the 45,000 tpy unit would be less than 1 pound per year of SO_2 (NOXSO April 1995, Revised).

Liquid SO_2 is currently delivered to the OCP site by tank truck. A caustic scrubber is used at the current SO_2 unloading station to minimize SO_2 emissions from unloading operations. However, a small amount of fugitive SO_2 escapes to the atmosphere when transfer lines are disconnected. During the NDP, fugitive SO_2 emissions from transfer line disconnections would

occur while on-loading rail cars with SO_2 produced at the site. Because rail cars carry 4.5 times more SO_2 than tank trucks, transfer line breaks would be less frequent with the NDP even though similar quantities of SO_2 would undergo vehicle transfers. Fugitive SO_2 emissions from transfer line breaks at the OCP would be expected to decrease from 200 pounds per year to 56 pounds per year with the NDP (NOXSO April 1995, Revised).

Fugitive emissions from valves and other process equipment would be minimal, as the liquid SO_2 plant would be constructed in accordance with regulatory requirements to limit these emissions. In addition, sulfur odors from the project would not be anticipated.

The area surrounding the OCP site experiences very dense fog under certain atmospheric conditions. The Hiwassee River system contributes by far the largest percentage of water vapor that condenses to form this natural phenomenon. The NDP would have negligible impacts on fog conditions. The only source of NDP water vapor to the atmosphere would be from the cooling towers. Drift and evaporative water losses from the existing cooling towers at the site would increase by only 2% due to the NDP.

An operating permit from the Tennessee Department of Environment and Conservation would be required for the caustic scrubber pollution control equipment on the liquid SO_2 plant. Construction and operation of the NDP would have a negligible impact on air quality.

4.2 WATER RESOURCES

The OCP is located on the southern bank of the Hiwassee River, at approximately Hiwassee River mile 17. The Hiwassee, a major tributary of the Tennessee River, provides water to the OCP and receives effluent from the site. In 1994, at mile 8.5 (the closest location assessed), the Tennessee Valley Authority rated the fish assemblage as "good" and the benthic assemblage as "fair"; there was no significant sediment toxicity.

The OCP diverts approximately 4.6 mgd of river water primarily for once-through cooling purposes and process water use. The NDP would require an additional 0.03 mgd of water over the current rate. No groundwater is used at the OCP, and none would be required for the NDP.

The OCP operates under a NPDES permit (No. TN00002461) issued by the State of Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The OCP has four permitted outfalls with a combined discharge rate of approximately 4.1 mgd.

The liquid SO_2 plant would generate approximately 0.008 mgd of industrial wastewater, an increase of <1% over current operations. Wastewater would consist of waste heat boiler blowdown (1 gpm) and cooling tower blowdown (4 gpm). The NDP boiler blowdown would be combined with the OCP boiler blowdown, monitored, treated in the OCP's existing phosphate treatment system, and discharged in accordance with NPDES permit limitations. Cooling water used by the NDP would be directed to the existing cooling tower system at the OCP, which has sufficient excess capacity to accommodate the project. There would be no appreciable impact from the NDP on the OCP wastewater discharge quality and quantity.

Construction of the NDP would require limited supplies of water on a short-term intermittent basis. Some discharge may occur from surface run-off. However, general construction practices, such as berming, silt fencing, and wetting, would be used to control soil losses and associated water quality impacts.

Stormwater run-off from the NDP would be collected in the existing stormwater collection system and treated under current practices. Storm sewers in the vicinity of the project site would adequately handle the slight increase in volume from the NDP.

Operation of the NDP would not require modification of the existing NPDES permit; however, written notification of the project to the Tennessee Department of Environment and Conservation would occur.

4.3 LAND USE

The OCP site is bordered on the east and west by topographically lower inlets of the Hiwassee River. The area around the OCP consists of minor valleys and ridges.

The NDP construction at the OCP site would occupy less than 1% of the total plant area - approximately an acre of currently unused, previously disturbed land east of the existing switchgear building (Figure 2-7). Construction would not disturb current OCP operations or impact vegetation.

Some relocation and additional construction would be required in the OCP rail yard to accommodate rail traffic associated with the liquid SO_2 plant. New sulfur and SO_2 stations, a new scale, and a rail spur containing a new hydrochloric acid station would be built; and two chlorine stations would be relocated. All construction would occur in the existing rail yard area,

so no impacts on vegetation would occur. The rail yard modifications are designed to integrate the liquid SO_2 plant into current OCP operations.

The NDP would not affect farmlands in the area.

4.4 ECOLOGY AND BIODIVERSITY

Since construction and operation activities associated with the NDP would occur entirely within a previously disturbed grass-covered area, no effects on vegetation, wildlife, or habitats are foreseen. The vegetation located east of the proposed site would not be disturbed by the project. Impacts on biodiversity would be negligible. DOE has received written concurrence from the U.S. Fish and Wildlife Service in a letter dated April 19, 1995, that the proposed project at the OCP would have no significant impact on any Federally endangered species or habitat (Appendix).

4.5 FLOODPLAINS AND WETLANDS

Based on the latest computed profile for the Hiwassee River, the 100-year frequency flood could be expected to reach an elevation of 695 feet above mean sea level at the OCP. According to a certified topographic survey of the plant, the proposed project site and the existing rail yard both lie above the 100-year flood elevation. The Federal Emergency Management Agency 1991 Flood Hazard Boundary Map incorrectly shows portions of the project site in the 100-year floodplain. OCP would formally request revision of the mapping to show the correct elevations.

The National Wetlands Inventory Map identifies scattered wetlands in the area along the Hiwassee River and South Mouse Creek. The inlet 150 feet east of the proposed project site (Figure 2-5) is identified as a wetland; it would not be encroached upon or impacted by the proposed construction, and no buffer zone requirements are imposed by State of Tennessee regulations.

4.6 WASTE MANAGEMENT AND POLLUTION PREVENTION

Waste Management

The OCP is classified as a large quantity generator of hazardous waste. The site's generator identification number is TND-00-333-7292. Three on-site landfills are used for disposal of gypsum and chloride salts generated at the site, as well as ash waste from an on-site mercury thermal recovery unit. In addition, the OCP has two inactive disposal sites that contain mercury and chloride wastes.

Construction of the NDP would generate construction-related wastes that would be properly classified as either non-hazardous or hazardous and transported to permitted off-site facilities for disposal.

Operation of the liquid SO_2 plant would generate the follwing wastes: sodium sulfite solution from caustic scrubbing, ash, filters, zeolite sieve material, and silica gel. The liquid scrubber waste (pH 10) would be directed to a small holding tank before being used onsite to neutralize acidic wastes generated by other OCP proesses. Approximately twenty 30-gallon drums of ash material would be generated as a result of cleaning the sulfur storage tank and molten sulfur day tank during the annual maintenance outage. The ash material would likely be iron oxides (products of corrosion) and carbon and ash impurities from the molten sulfur. This ash is expected to be non-hazardous, however, the ash would be analyzed before disposal in accordance with State and Federal regulations. Filters used in the SO_2 production process to remove elemental sulfur from the SO_2 stream would be disposed as a non-hazardous waste.

The zeolite sieve material, used to remove carbon dioxide and moisture in the air separation unit, is composed of porous crystalline aluminosilicates. Silica gel waste from the hydrocarbon adsorber of the separation unit would also be generated. The amount and frequency of zeolite and silica gel waste generation are unknown at this time, but is estimated to be 1,000 pounds per year. The zeolite and silica gel wastes are not expected to be classified as hazardous wastes; however, both would be analyzed before disposal in accordance with all applicable regulations.

Pollution Prevention

The liquid SO_2 plant incorporates pollution prevention in its basic design: combustion of elemental sulfur with pure oxygen eliminates waste streams generated by the standard industry technique of burning sulfur in air to produce SO_2. In addition, sodium sulfite produced from the liquid SO_2 plant scrubber would be used in an existing OCP process.

4.7 CULTURAL AND HISTORIC RESOURCES

The Tennessee Historical Commission, in a letter to DOE dated April 5, 1995, has stated that the proposed project would not affect any listed or eligible properties in the National Register of Historic Places (Appendix). There are no scenic resources in the area that would be affected by the proposed project, nor would Native American resources or national forest areas be impacted.

4.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Construction activities for the NDP would occur over a 12 month period and would require approximately 20 construction personnel. This would create short-term employment for the local and regional labor force. Operation of the liquid SO_2 plant would be integrated into Olin's other operations, and would require four engineering and operations personnel. The project would not create any environmental equity concerns as all activities would occur at an existing industrial site.

Currently, liquid SO_2 production within the U.S. supplies 75% of the U.S. marketplace demand; the remaining 25% is supplied primarily from Canada. The OCP would produce 45,000 tpy of liquid SO_2, or 12% of the U.S. demand. It is estimated that the OCP would displace a portion of the current market supply (possibly Canadian production due to transportation distances and costs). Merchant demand for liquid SO_2 is growing at a rate of about 3% per year; thus, increased demand would potentially absorb the proposed project's output by the year 2000. Olin facilities would use 32,000 of the 45,000 tpy, further minimizing market impacts. Construction and operation of the proposed project at the OCP are expected to have no disproportionate negative impacts on environmental equity.

4.9 TRANSPORTATION

Access to the OCP is via Lower River Road, which runs east-west about a mile south of the OCP. About 2 miles west of the OCP is U.S. Interstate 75. The OCP currently receives about 350 commercial truck deliveries, 35 rail car deliveries, and 5 barge deliveries per week; employee passenger vehicle traffic averages about 3,000 trips per week. Additionally, the OCP currently makes 700 truck and 100 rail car shipments per week, and 5 barge shipments per month.

The NDP construction activities would temporarily increase truck traffic at the OCP by about 1%, and passenger vehicle traffic by about 3%. Operation of the liquid SO_2 plant would increase passenger vehicle traffic by about 1%, and decrease truck traffic by about 5%, because liquid SO_2 would no longer be trucked to the site.

Sulfur arriving from WPP at Newburgh, Indiana would be off-loaded at the OCP by approximately four rail cars per week; off-site liquid SO_2 shipping would require about five rail cars per week. Overall, rail car traffic at the OCP would increase by about 7%. Depending on the future buyer for the liquid SO_2 not used by Olin Corporation facilities, some SO_2 may leave the site by tank truck. Based upon these small percentage changes, transportation impacts from the NDP at the OCP would be minimal.

4.10 NOISE

Existing noise generation at the OCP is typical of levels experienced at chemical process industry facilities. During construction, a small increase in on-site noise levels would be expected. Since the nearest residential receptor is approximately 3/4 mile away and construction would be limited to daylight hours, no adverse impacts on the surrounding community would be anticipated from the short-term construction activities.

Activities associated with NDP operations would produce a broad-band noise spectrum. Workforce noise is regulated by the Occupational Safety and Health Administration; proper hearing protection would be used and a hearing conservation program would be implemented. Residential receptors are expected to experience no change in noise levels from those currently generated by the OCP site.

4.11 HEALTH AND SAFETY

Potential health and safety hazards to on-site workers and the surrounding community from the construction and operation of the NDP at the OCP would be minimized through use of standard industrial practices. As with the NDP at the WPP, an in-depth process hazard review would be performed prior to construction, to identify any potential hazards and to incorporate safety engineering design features into the system (including seismic design criteria). In addition, for both construction and operation activities, safety programs would be implemented to reduce the risk of accidents. Written hazard communication programs would be established to inform workers of potential chemical hazards. On-going training of personnel would further reduce the risk of accidents and exposure to hazardous substances. Federal regulations would serve as the foundation for health and safety plans and procedures, and Chemical Manufacturers Association guidelines would also be followed for management of hazardous chemicals.

The major health and safety risk from the NDP would involve the production and handling of liquid SO_2. The OCP currently stores approximately 190 tons of liquid SO_2 on-site. During operation of the liquid SO_2 plant at the OCP, on-site storage would increase to approximately 250 tons. The OCP is currently above the Emergency Planning and Community Right-to-Know Act (EPCRA) threshold planning quantity for SO_2 and chlorine; therefore, Olin already has detailed health and safety plans and procedures for handling SO_2 under normal operating and accident conditions. These plans include the required emergency response procedures. The quantities of SO_2 present currently and during the proposed NDP also make the facility subject to the Federal Process Safety Management regulation (29 CFR 1910.119) and the Clean Air Act Chemical Accident Prevention regulation (40 CFR 68). Olin's existing health and safety plans would be revised to incorporate procedures specific to the liquid SO_2 plant and liquid SO_2 rail car loading. Appropriate training in handling emergency procedures would be provided for all personnel.

The OCP's current supply of liquid SO_2 (20,000 tpy) is transported to the site by truck (approximately 20 deliveries per week). During operation of the liquid SO_2 plant at the facility, all liquid SO_2 required for the OCP would be produced on-site. Annual off-site shipments of liquid SO_2 would consist of 12,000 tons transported by rail to an Olin facility in Georgia; an

additional 13,000 tons would be transported off-site by rail or truck to a future buyer. Reduced SO_2 trucking as a result of the NDP would offer transportation safety benefits.

The liquid SO_2 plant is similar to other processes which routinely operate nationwide. It is extremely unlikely that substantial quantities of hazardous substances would be released from the liquid SO_2 plant. Appropriate safeguards for the liquid SO_2 plant and SO_2 handling would be implemented throughout the project to provide a level of environmental protection consistent with responsible industry standards.

4.12 ENERGY AND MATERIAL RESOURCES

Energy and material resources required for operation of the NDP would include: sulfur, oxygen, water, caustic and electrical power (Table 2-2).

The liquid SO_2 plant would require about 23,100 tpy of sulfur, of which 16,000 tpy would be supplied by the SRU at the WPP. The additional sulfur would be purchased on the open market. The process would require about 22,950 tpy of 99.5% pure oxygen which would be supplied by the proposed on-site air separation unit. Operation of the liquid SO_2 plant would require about 0.03 mgd of water from the Hiwassee River. To operate the caustic scrubber on the SO_2 plant, approximately 5,712 tpy of caustic would be required. Operation of the NDP would require and additional 9,636 MWhr/yr of electricity. Water, caustic, and power requirements for the proposed NDP are negligible compared to existing demand for these resources at the OCP. No adverse effects would be expected from the project's resource requirements.

4.13 LONG-TERM AND CUMULATIVE IMPACTS

The proposed liquid SO_2 plant would continue to operate at the OCP after the two year demonstration project. The proposed project is environmentally neutral at the OCP site, in comparison to the positive benefit at the WPP site where Unit 2 pollutant emissions would be substantially reduced. Long-term environmental impacts would be similar to those described for the NDP. There are no known large-scale projects proposed for Bradley or McMinn counties in Tennessee that, in conjunction with the NDP, would create adverse cumulative impacts.

4.14 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, whereby DOE does not provide cost-shared funding support, it is likely the NOXSO process would not be constructed at the WPP. Consequently, the liquid SO_2 plant at the OCP would not be constructed to recycle the sulfur by-product of the NDP. Environmental conditions at the OCP would remain the same. In the unlikely event that the NOXSO process was demonstrated at WPP without DOE participation, the anticipated environmental impacts at OCP would be the same as described in this EA.

5.0 LIST OF AGENCIES AND PERSONS CONSULTED

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Scenic Rivers Administrator, Division of State Parks
Tennessee Department of Environment and Conservation
Department of State Parks, Scenic River Program
7th Floor, L & C Tower
401 Church Street
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McMinn County Executive
McMinn County Executive Office
6 West Madison
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Section Chief
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Billy Pugh
Environmental Specialist
Tennessee Department of Environment and Conservation
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9th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1531

Warrick County Planning Commission
Warrick County Court House, Rm 107
Boonville, IN 47601

6.0 REFERENCES

American Conference of Governmental Industrial Hygienists. "Threshold Limit Values for Chemical Substances". 1993-1994.

Buonicore and Davis. "Air Pollution Engineering Manual". Van Nostrand Reinhold, NY. 1992.

Calabrian Chemicals. "SO_2 Unit Review, Port Neches, TX Plant". January 1995.

Department of Agriculture Soil Conservation Service. "Soil Survey, Bradley County, TN". July 1958.

DOE Assistant Secretary for Fossil Energy. "Clean Coal Technology Demonstration Program Update-1993". March 1994. DOE/FE-0299P.

DOE Office of NEPA Oversight. "Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements". May 1993.

EPA. "Compilation of Air Pollution Emission Factors - Volume I: Stationary Point and Area Sources, AP-42, Fourth Edition". September 1985.

NOXSO Corporation. "Environmental Information Volume for the NOXSO Demonstration Project". April 1995 (Revised).

Office of the Federal Register, National Archives and Records Administration. "40 CFR, Protection of Environment". 1994.

APPENDIX

AGENCY CONSULTATIONS

Warrick Power Plant Site:
Letters from Fish and Wildlife Service; Indiana Department of Natural Resources Division of Historic Preservation and Archaeology.

Olin Charleston Plant Site:
Letters from Fish and Wildlife Service; Tennessee Historical Commission.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, Indiana 47403-2121
(812) 334-4261 FAX 334-4273

IN REPLY REFER TO:

March 6, 1995

Mr. Joseph B. Renk III
Office of Clean Coal Technology
Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

Project: Clean Coal Technology Demonstration Project at Alcoa Generating Company
County: Warrick

Dear Mr. Renk:

This responds to your letter dated February 23, 1995, requesting our comments on the aforementioned project.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The proposed project will have no significant effect on wetlands and will not affect any Federally endangered species. Other project impacts will be minor in nature. Based on a review of the information you provided, the U.S. Fish and Wildlife Service has no objections to the project as currently proposed.

We appreciate the opportunity to comment at this early stage of project planning. If project plans change such that fish and wildlife habitat may be affected, please recoordinate with our office as soon as possible. If you have any questions about our recommendations, please call (812) 334-4261.

Sincerely yours,

Michael S. Litwin

David C. Hudak,
Supervisor

INDIANA DEPARTMENT OF NATURAL RESOURCES

PATRICK R. RALSTON, DIRECTOR

Division of Historic Preservation
and Archaeology
402 W. Washington St., Rm. 274
Indianapolis, Indiana 46204
317-232-1646

March 14, 1995

Joseph B. Renk III
Office of Clean Coal Technology
Department of Energy
Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

Dear Mr. Renk:

We have reviewed the proposed demonstration project at Alcoa Generating Company's Warrick Power Plant in Newburgh, Warrick County, Indiana.

No known historical, architectural, or archaeological sites listed in or eligible for inclusion in the National Register of Historic Places will be affected by this project.

If any archaeological artifacts or human remains are uncovered during construction, federal law and regulations (16 USC 470, et seq.; 36 CFR 800.11, et al.) and, additionally, state law (Indiana Code 14-3-3.4), require that work must stop and that the discovery must be reported to the Division of Historic Preservation and Archaeology within two (2) business days.

We appreciate the opportunity to be of service.

Very truly yours,

Daniel J. Fogerty

Patrick R. Ralston
State Historic Preservation Officer

PRR:JAM:MMD:smg

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

April 19, 1995

Mr. Joseph B. Renk III
Office of Clean Coal Technology
U.S. Department of Energy
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

Re: FWS #95-1394

Dear Mr. Renk:

Thank you for your letter and enclosures of March 24, 1995, regarding a proposal by NOXSO Corporation to conduct a demonstration project under the Clean Coal Technology Round III Program. As part of the project, a liquid sulfur dioxide plant will be constructed and operated at the Olin Chemical Corporation facility near Charleston in Bradley County, Tennessee. The Fish and Wildlife Service (Service) has reviewed the information submitted and offers the following comments.

Upon review of available information, the Service concurs that construction and operation of the liquid sulfur dioxide facility, as proposed, is not likely to adversely affect the federally threatened snail darter. In view of this, we believe that the requirements of Section 7 of the Endangered Species Act have been fulfilled and no further consultation is needed at this time. Consultation should be reinitiated, however, if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

Thank you for the opportunity to comment. If you have questions, please contact Jim Widlak of my staff at 615/528-6481.

Sincerely,

Robert T. Bay

Robert T. Bay
Acting Field Supervisor

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

April 5, 1995

Mr. Joseph B. Renk III
Pittsburgh Energy Technology Center
Post Office Box 10940
Pittsburgh, Pennsylvania 15236-0940

RE: DOE, LIQUID SULPHER PLANT, CHARLESTON, BRADLEY COUNTY

Dear: Mr. Renk

Pursuant to your request, this office has reviewed your letter relative to the above-referenced undertaking. Considering available information, we find that the project as currently proposed will not affect any cultural resources eligible for listing in the National Register of Historic Places.

Therefore, this office has no objection to the implementation of this project. Should project plans change, please contact this office to determine what additional steps, if any, compliance with Section 106 requires. You may direct questions and comments to Joe Garrison (615)532-1559. This office appreciates your cooperation.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg