Waste Isolation Pilot Plant
Medical Screening Program

Phase I: Needs Assessment

Presented to the Office of Worker Screening and Compensation Support,
Office of Health, Safety, and Security
U.S. Department of Energy

Prepared by

Queens College, City University of New York
United Steelworkers

Original Draft: August 22, 2011
Updated Version: May 1, 2012

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Summary

Background: The objective of this report is to characterize hazardous exposures to workers at the Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) and to determine if a medical screening program is warranted. This activity is undertaken as part of the DOE Former Worker Program as mandated by the Defense Authorization Act of 1993.

Methods: Quantitative and qualitative analysis of WIPP health and safety records were performed; public records and literature were reviewed; site visits were conducted; and structured interviews with workers were administered. Additionally, a toxicological overview of the hazardous exposures found at WIPP was completed and recommendations for specific medical tests to identify related health outcomes are presented.

Results: In summary, this report has found:

- *Hazardous risks at WIPP:* Eight major potential exposure hazards with known human health effects have been identified at WIPP including: salt dust, diesel exhaust particulate (DEP), carbon tetrachloride (CCl_4), volatile organic compounds (VOCs), welding fumes, ionizing radiation, noise and lead.

- *Recommended screening tests:* Based on the exposure characterization at WIPP, the following tests are recommended to be administered for all participants: medical and occupational histories, physical examination, chest radiograph, spirometry, complete blood count, and audiometry. The following tests are recommended to some participants based on exposure history: blood biochemistry test, blood lead, and urinalysis.

- *Workforce:* The estimated former workforce eligible for medical screening is over 500, with an additional group of over 700 who may become eligible by 2021.

Conclusion: Potential for hazardous exposures has existed for the WIPP workforce since 1990. Based upon the site exposure characterization and the identification of appropriate medical screening procedures, we recommend medical screening of former WIPP workers as part of the DOE Former Worker Medical Screening Program.

I. Background on the Former Worker Program

The Department of Energy (DOE) Former Worker Medical Screening Program (FWP) was created by a Congressional mandate in the Defense Authorization Act of 1993, Public Law 102-484, Section 3162, to evaluate the health of former workers who are at significant risk for occupational illness associated with hazardous exposures related to their work at DOE nuclear defense facilities. Queens College of the City University of New York, in a consortium with the United Steelworkers International Union and the Atomic Trades and Labor Council, presently holds a cooperative agreement with the DOE to implement the FWP as the Worker Health Protection Program (WHPP) at nine DOE facilities.

To date, WHPP has screened over 20,000 former workers and performed over 26,000 examinations, including three-year follow-up exams. Program wide, WHPP has reported the following potentially work related medical findings of its participants as of September 30, 2010:

- Chest x-rays: 6.2% demonstrated findings consistent with work-related lung disease.
- Pulmonary function tests: 20.7% demonstrated findings consistent with obstructive disease.
- Beryllium lymphocyte proliferation test (BeLPT): 1.7% were sensitized to beryllium.
- Audiometry: 52.1% demonstrated hearing loss for normal speech tones.

Following DOE guidelines for FWP cooperative agreement holders, the implementation of medical screening at a new facility occurs in two stages. The first stage, or Phase I, consists of a needs assessment to examine the need for and feasibility of a medical screening program. The second stage, Phase II, consists of implementing the medical screening program based on the findings of Phase I. In late 2010, Queens College and the United Steelworkers were tasked with conducting a Phase I to determine the need for a medical screening program for former workers of the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. This needs assessment builds upon WHPP's experience administering the FWP at the nine other DOE facilities.

Similar to the implementation of medical screening programs at other WHPP sites, the focus of this Phase I is on exposures to employees of the prime contractors and non-building trades sub-contractors; the Center for Construction Research and Training (CPWR) is scheduled to administer the FWP for building trades subcontractors from the WIPP facility. WHPP will coordinate activities with the CPWR program where appropriate.

WHPP is governed by an Institutional Review Board (IRB) as defined by Title 45 CFR Part 46 in order to protect human subjects. All aspects of this needs assessment involving participation of human subjects were approved by both the Queens College and central DOE institutional review boards.

II. History of the WIPP Facility

Overview

In contrast to all other DOE facilities, the Waste Isolation Pilot Plant's main operational goal is to handle and safely store, for a period of at least 10,000 years, transuranic (TRU) waste produced as a bi-product of nuclear weapons production (EPA 2011). TRU waste consists of materials contaminated with alpha emitting transuranic radionuclides that have a concentration greater than 100 nCi/g and a half-life of at least twenty years. Large amounts of toxic TRU waste have been produced by the United States nuclear weapons program since the mid-1940's (Biedsheid et al. 2003). Initially, nuclear weapon producing facilities including Los Alamos, Oak Ridge National Laboratory, Idaho National Engineering and Environmental Laboratories (INEEL), Savannah River and Rocky Flats, developed their own internal disposal facilities for TRU waste. During the early stages of the DOE weapons complex, TRU waste was

not handled significantly differently than the typical waste stream, commonly being disposed of in on-site trenches, storage tanks or nearby canyons (Rechard 2000).

In 1955, the public and environmental health risks of TRU waste were fully acknowledged by the Atomic Energy Commission (AEC), who in turn tasked the National Academy of Science (NAS) to find a suitable "permanent" storage facility with the goal of protecting human health. After reviewing multiple options, the NAS recommended the storage of TRU waste in deep rock salt (NaCl) beds (Rechard 2000). Salt beds were chosen for several reasons: there is little or no groundwater present, reducing the risk of migration of escaped contaminants; salt beds generally exist in stable geological areas where there is a reduced risk for earthquakes; and fractures in the salt beds are self-healing and in time the carved space where the waste was to be deposited would naturally be filled in, trapping and sealing escaped waste from the environment (WIPP 2007). The initial conclusions of the NAS were reaffirmed in deep-rock salt-bed analysis performed by Oak Ridge National Laboratories throughout the 1960s (Rechard 2000).

Planning and Construction

In 1974, the Energy Research Development Agency (later replaced by the DOE) funded the Sandia Laboratory to research a facility for permanent storage of TRU waste in southeast New Mexico. By 1976, they located the present WIPP site in the salt mines located twenty-six miles southeast of Carlsbad, New Mexico. The mines are located in proximity to other NaCl, potash, oil and natural gas fields (WIPP 2007). In 1977, the conceptual design for the facility was complete and in 1978, Bechtel National won the contract to design and engineer it, while Westinghouse Electric Corporation provided technical support (WIPP 2007).

In 1979, Congress authorized the DOE to create WIPP and to conduct research and development to show that safe disposal practices of TRU waste were achievable. In 1981, the DOE issued a record of decision from an environmental impact statement, allowing construction of WIPP to begin. In 1982, the Army Corps of Engineers took over design and implementation of the program, and began to dig the initial shafts of the WIPP facility. Construction as well as additional planning and testing of WIPP occurred throughout the 1980s (WIPP 2007).

By January 1990, the construction of WIPP was officially completed. In total, there are four vertical shafts bored 2,150 feet into the ground for the purposes of salt removal, waste transportation, air intake and exhaust. Above ground construction includes about thirty surface buildings and covers 234,000 sq. feet. The primary buildings at WIPP are the Waste Handling Building and the Underground Storage Facility (the mine), where waste is received and stored, respectively. In addition to the construction of the facility, improvements of surrounding roads, highways and by passes were constructed in order to lessen the risk of accidents during transportation (DOE 2010).

During the time of construction, Sandia was tasked with ensuring WIPP compliance with EPA regulation 40 CFR 191 for environmental radiation protection standards for management and disposal of spent nuclear fuel and high-level transuranic radioactive wastes. For ten years, Sandia performed extensive tests and analysis of potential hazards based both on current scientific understanding and an incorporation of hypothetical uncertainty through the use of mathematical modeling. The documentation of their analysis demonstrating their adherence to 40 CFR 191 was submitted to the EPA in 1996 and totaled 20,000 pages. Two years later, the EPA certified that WIPP was in compliance with the regulation (Rechard 2000).

Implementation and Present Use

WIPP was constructed to receive two types of TRU waste, Contact Handled (CH-TRU) and Remote Handled (RH-TRU) waste.CH-TRU waste is characterized as waste with an external radiation

dose rate less than or equal to 200 mrem/hr at the surface of the container and can be handled under controlled conditions with no shielding other than the container. RH-TRU has a higher level of penetrating radiation, mostly alpha, greater than 200 mrem/hr and must be handled in lead-shielded casks (Biedscheidet al. 2003). The nature of both types of TRU waste received are items contaminated with radioactive elements, typically plutonium, and include clothing, tools, rags, residues, debris, soil, sludge and other items. The majority of waste received at WIPP is CH-TRU; the final destination within the repository differs based on whether it is Contact Handled or Remote Handled waste.

Prior to 1990, physical operations at WIPP were strictly limited to construction activities. From 1990 through 1999, Westinghouse, the prime contractor, operated WIPP. For the nine-year period after construction and prior to receiving shipments of waste in 1999, the site was nearly fully staffed with employees engaged in underground mining activities and in safety and operation readiness reviews (Project Staff 2011).

WIPP received its first shipment of CH-TRU in March 1999 from the INEEL and Rocky Flats facilities. Westinghouse continued as prime contractor, changing their name in 2002 to Washington TRU Solutions (WIPP 2007). Operations of receiving and storing CH-TRU waste continued through the 2000s and in 2007, WIPP received its first shipment of RH-TRU waste. Prior to reaching WIPP for final disposal, a consolidation of materials occurs at Idaho National Lab from contributing DOE sites. It is here that the waste is treated and characterized prior to its permanent storage. Once treated and characterized, the TRU waste is loaded into TRU-Pact storage drums, which meet the criteria of 40 CFR 191, and is securely trucked to the WIPP facility (WIPP 2007).

In October 2010, WIPP received its 9,000th shipment of TRU waste (DOE 2010). WIPP is presently governed by Public Law 102-579, "The Waste Isolation Pilot Plant Land Withdrawal Act," which sets the maximum storage at 6.2 million cubic feet of TRU waste. As of October 2010, over 2.5 million cubic feet were in storage; WIPP will likely reach its regulatory capacity within the next five to ten years (Project Staff 2011). To date, WIPP is the only U.S. facility to store TRU waste permanently.

Health and Safety Infrastructure

WIPP facilities and functions are overseen by various federal and state agencies, including DOE, USEPA, NMDEP, NMED, and USOSHA. In order to comply with worker health and safety as well as environmental regulations, WIPP employs a staff that includes a safety specialist, an industrial hygienist, radiation protection specialists, and environmental engineers. This staff and a support staff of trained technicians conduct the following activities: ongoing personal and ambient monitoring to assess worker exposure to a variety of chemical and physical hazards; training of workers to recognize and protect themselves from hazards, including the use of respiratory protection; emergency response exercises and training; measurement of radiation levels in areas where TRU waste is received, handled and stored, as well as personal radiation dosimetry. There is an off-site lab located in Carlsbad that analyzes environmental samples (both chemical and radiation); ambient air personal samples are sent to accredited laboratories for analysis.

In addition to these staff, WIPP has a medical staff consisting of an off-site occupational medicine physician and two nurses with practical experience in occupational health, one of whom works in Carlsbad and another at the WIPP site. The nurses' main work consists of conducting incoming medical assessments of new employees, occupational screening exams for employees with noise exposure and respirator clearance exams for members of the mine safety rescue teams. The nursing staff also provides acute but limited medical care for injuries. At the WIPP facility there is an on-site Emergency Medical Services team that, if needed, transports injured workers to a local hospital. The off-site physician conducts medical clearance and return-to-work examinations and evaluates individuals with work-related medical complaints.

WIPP staff keeps records of these activities, some of which are readily available on its web site at: http://www.wipp.energy.gov/index.htm. Mandated OSHA and DOE logs of illnesses and injuries are maintained, including reports of incidents impacting worker safety and health. There is a database of the personal monitoring results maintained by the site industrial hygienist as well as records of ambient air monitoring throughout the facility, especially in the areas where waste is received, handled and stored. Records are also kept of personal radiation dosimetry. The site nurses maintain a database of all employees that contains the results of medical screening tests conducted as part of the employee's screening and surveillance testing.

Engineered protections are also in place to guard against adverse chemical exposures. Chemical exposures are controlled by a ventilation system that serves the underground storage areas. Outside air is drawn from an above ground shaft into the underground areas and exhausted through another shaft positioned at the other end of the storage area. The ventilation system is designed so that clean air moves over workers and then over the waste storage areas from where it is exhausted to the outside. Additionally, there is a secondary ventilation system by means of which air is exhausted from the closed waste storage rooms via fans connected to flex duct, which pass through carbon filters that trap the CCl_4 and other VOCs.

III. Scope of this Report

This report characterizes the potential exposures to workers at the WIPP facility since the first TRU waste was received in March 1999. In addition, since mining and underground safety and planning activities were active before this time, the exposures generated during mining activities are pertinent to miners and others who worked underground since 1990. The exposure characterization is based upon data and information gathered from the following sources:

- Industrial hygiene database
- Radiation dosimetry database
- Hearing conservation program data
- WIPP Annual Site Environmental Reports (2002-2009)
- OSHA logs (1999-2003)
- Occurrence Reporting and Processing System (ORPS) reports
- Site visits to the WIPP facility that included:
    - Meetings with management personnel, including health and safety specialists
    - Meetings with union leadership
    - Facility walkthrough
- Structured interviews with workers

Site Visit

The WHPP team visited the site twice, once from June 1-3, 2010 and again from February 22-23, 2011. The purpose of the first visit was to introduce the FWP program to WIPP and DOE personnel and to engage DOE and site personnel who would assist WHPP as we initiated the site needs assessment. BT-MED, USW, and Queens College WHPP were represented at the meeting.

The goals of the second visit were to gather information and data on:

1. Worker tasks and potential exposures to chemical and physical agents;
2. Physical layout of buildings and operations;
3. Site safety programs, environmental monitoring and history of incidents;
4. Medical screening programs for WIPP workers;

5. Workers' compensation and history of medical plans; and
6. Identification of former workers

IV. Exposure Characterization

Exposure characterization includes the following:

A. Description of the worksite locations and major job tasks performed at these locations
B. Classification of the significant potential chemical and physical exposures at WIPP
C. Exposure levels reported by the WIPP facility
D. Worker interviews
E. Summary of potential exposures and tasks

These are outlined below.

A. Worksite Locations and Major Job Tasks

Although WIPP has about 30 buildings, trailers and equipment sheds spread across 234,000 sq. ft., there are two primary locations where workers perform tasks that potentially expose them to chemical and physical hazards. These locations are the Waste Handling Building and the Underground Storage Facility (described above). It is at these two locations where waste is received, assessed, transported and stored. Potential exposure to lead occurs at the firing range. Tasks at the Waste Handling Building are available online at http://www.wipp.energy.gov/fctshts/factsheet.htm and are as follows:

- A waste shipment arrives by tractor-trailer. Each tractor-trailer is capable of carrying up to three Transuranic Packaging Transporter Model IIs (TRUPACT-IIs) or HalfPACTs.
- Upon arrival the tractor-trailer and TRUPACT-IIs/HalfPACT's undergo a security inspection, a radiological survey, and a shipping documentation review.
- Once the shipment checks are completed, the tractor-trailer will be parked near the Waste Handling Building where a forklift transfers each TRUPACT-II/HalfPACT from the trailer, through an air lock, and into the Waste Handling Building.
- Inside the building, each TRUPACT-II/HalfPACT is placed in a TRUDOCK (specially designed holding dock), which holds the shipping container in place while workers unload the waste.
- An overhead crane is used to remove the TRUPACT-II/HalfPACT lids.
- Radiological surveys are conducted throughout the waste handling process to confirm waste containers have not sustained damage during shipment or waste container removal.
- The overhead crane then removes the waste containers from the TRUPACT-II/HalfPACT and places them on a facility pallet. The three different waste container configurations are two seven-packs (55-gallon steel drums configured in seven packs), two standard waste boxes, or one ten-drum over pack.
- A forklift moves the loaded facility pallet to the conveyance loading car inside the air lock at the waste handling shaft.
- The conveyance-loading car is used to load the facility pallet onto the waste hoist (mine elevator).
- The waste hoist descends 2,150 feet to the WIPP repository.

Once the waste has been transported underground, the following steps are taken:

- An underground transporter pulls the loaded facility pallet off the hoist onto the transporter bed and moves the waste to the appropriate disposal room.
- A forklift is used to remove the waste containers from the facility pallet and moves the waste to the disposal area.

- Bags of magnesium oxide are placed on top of and around the containers to serve as backfill. The magnesium oxide serves to control the solubility of radionuclides and is an added measure of assurance to long-term repository performance.

The major tasks performed by workers at the Waste Handling Building and the Underground Storage Facility can be categorized generally as follows:

1. Transport TRU waste, equipment and mined waste;
2. Assess radiological and chemical waste in water, air and soil;
3. Expand the existing underground storage facility by mechanical excavation (mining) of the salt;
4. Secure waste behind fixed barriers;
5. Maintain the facilities and vehicles.

B. Classification of the Chemical and Physical Exposures.

The following potential chemical and physical hazards have been identified based on a review of the sources listed in III above.

- **Carbon tetrachloride (CCl_4)** is the predominant VOC present in the waste and is found in solidified organic sludge from Idaho and Rocky Flats, where it was used as a cleaning agent (Rotert 2011). It is emitted from containers that hold such sludge, and reaches high concentrations in underground sealed panels where waste containers have been emplaced.
- **1,1,1-Trichloroethane** is the second most frequently occurring VOC in the waste, and, like CCl_4, is emitted from the waste containers, although in lower concentrations.
- **Other VOCs** are present in the waste. The following have been identified by ambient air monitoring: 1,1,2,2-Tetrachloroethane, 1,1-Dichloroethylene, 1,2-Dichloroethane, Chlorobenzene, Chloroform, Methylene chloride and Toluene (WIPP 2009)
- **Diesel Exhaust Particulate (DEP)**, also called diesel particulate matter (DPM), is generated by the many diesel powered vehicles and equipment used for mining and hauling of waste.
- **Welding Fumes** are generated during welding operations performed in the mechanics shop (underground) and during construction of bulkheads. The task is overwhelmingly metal inert gas (stick) welding of mild steel. The following metals have been identified in ambient air personal monitoring samples: antimony, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, vanadium and zinc.
- **Salt Dust** generated during mining, hauling and disposal operations, largely in the underground storage facilities (mines), which are frequently being expanded to make space for more waste.
- **Lead dust** is generated at the firing range where security personnel practice use of weapons. Lead dust can accumulate in such areas and become airborne due to disturbance of surfaces by vehicular and foot traffic and by movement of air.
- **Noise** is created by heavy machinery, vehicles and compressors used in the waste handling building and underground storage areas. Because of the physical layout underground, sound waves can be readily magnified by reverberation off of surrounding surfaces.
- **Ionizing radiation** is contained in all waste brought to the facility.

C. Exposure levels reported by the WIPP facility

Table 1 presents a summary of exposure assessment data extracted from a spreadsheet given to us by WIPP industrial hygiene staff at the February 2011 site visit, with updated beryllium records provided in January 2012. Exposure assessment data are presently on file at Queens College and can be furnished

upon request. Data are presented for most of the substances to which potential exposure is deemed of concern. We cannot attest to the quality or completeness of the data. It is also important to note the dates when samples were taken, since measurements were made over a period of about 11 years, but by no means in a temporally consistent manner. In fact, some chemicals were not measured for a number of years, as shown in the exposure data. Note that units presented in the table are consistent with those provided by WIPP. Units are different for different categories of substances (e.g., vapors vs. dusts).

Table 1: Summary of Exposure Assessment at WIPP Facility

Substance	N	Mean	Range	StdDev
CCl_4	136	0.17 ppm	0.055 – 0.54 ppm	0.45
DEP (EC[1])	100	41.7 (GM[2]: 21.9)	2.5 - 882 ug/m^3	89.7
DEP (OC[3])	62	59.7 ug/m^3 (GM: 37.5)	2.5 – 204 ug/m^3	51.7
DEP (TC_{2004})[4]	17	162 ug/m^3	29 – 259 ug/m^3	67.6
Salt dust	4	3.87 mg/m^3	1.10 – 10.69 mg/m^3	
Be (Salt dust)	66	Non-detect		
Be (Welding)	8	Non-detect		

[1]Elemental Carbon
[2]Geometric Mean
[3]Organic Carbon
[4]Total Carbon for samples taken in 2004

The monitoring results for **CCl_4** summarized in the table are based on different sampling media and methodologies that include passive dosimetry (great majority of samples), charcoal tubes, detector tubes and direct reading instruments. Since the sampling and analytical errors are different for the different methods, and since the passive-dosimetry and charcoal-tube samples represent personal, full-shift samples, whereas the others do not, no in-depth statistical analysis was attempted. The levels of CCl_4 are below the OSHA PEL of 10 ppm, the ACGIH TLV of 5 ppm and the NIOSH REL of 2 ppm as a Short Term Exposure Limit. However, the record that we have has noticeable gaps in monitoring dates. There are no samples prior to 2005, during which year 15 measurements were made, all on the same day; there is then a gap of 5 years when, in 2009 (December), 3 measurements are reported. The remaining measurements, 83 in all, were taken in 2010. Also, there appear to be no measurements made to assess the short-term exposure that workers would be expected to experience. According to the presentation made during the site visit "waste generated VOC's were not present at occupational levels of concern prior to late 2009 (Roter 2011)."

Concentrations of **DEP** were measured in terms of elemental and organic carbon. The sampling is sporadic between 2001 and 2010. The most updated standard is that of MSHA, which is 160 ug/m^3 (8-hr TWA), total carbon (TC=EC+OC). To get some idea of the magnitude of exposure, we calculated the TC by adding the values for EC and OC for 2004. The mean concentration for 17 samples, 162ug/m^3, was slightly above the current MSHA standard of 160ug/m^3.

We were provided results for only four samples for **salt dust**, three of which were taken on the same day (2/25/2009). Since there is no standard for salt dust, it was compared to that for the ACGIH TLV for particulate not otherwise classified (PNOC). The TLV for PNOC is 5 mg/m^3. Levels of salt dust measured for the four samples were 10.691, 2.13, 1.57 and 1.20, respectively. In addition to the mass of

salt dust captured in each sample, the analysis provided a metal scan for 13 metals. Only trace amounts were reported for most of these.

Welding fume was analyzed for 12 metals, most of the levels of most metals were low.

Personal **noise** exposure measurements were made at least since 1990. They demonstrate a great range of exposures. However, many measurements were above the OSHA PEL of 90 dBA. 90 of 403 (22%) full-shift measurements were ≥ than the OSHA PEL of 90 dBA and 16 measurements were ≥ 100 dBA. Fifty-nine (14.6%) measurements were ≥ 85 dBA, the OSHA Action Level.

D. Workers Interviews

Telephone interviews were conducted between April 26th and May 24th, 2011 with nine current workers. Interviews elicited information on the workers' job history, job locations, tasks and exposures to chemical and physical agents for each job title they have held. In addition, participants were queried about ionizing radiation exposure and results of personal dosimetry. Participants were also asked about their use of personal protective equipment and to report any other information that they thought might be relevant, including accidents and incidents at their work locations or changes in work practices and procedures that took place over time. In addition, participants were asked whether they had any medical concerns related to their employment at WIPP.

The majority of the workers interviewed have held more than one job title during their tenure at WIPP. Nine workers, holding a total of 15 jobs at WIPP, were interviewed. The standardized questionnaire and the informed consent form, which had previously been approved by the QC IRB, were sent to, and received by, each participant prior to the interview. A copy of the questionnaire can be found in Attachment 1.

Workers were invited to participate in the interviews after the local union furnished Queens College with a list of current workers identified as likely to have an interest in participating. Due to limited access to former employee information by the union, only active WIPP workers were invited. Although we were unable to use a random sample of employees, we believe that the information provided to us is accurate, as it was consistent among participants and when compared to data from other sources. Since workers were identified by the union, there is a possibility that the participants represent a biased group—that is, one that consists of individuals with greater exposure concerns. In addition, the small number of participants (n=9) does not allow for easy generalization to the entire cohort of WIPP employees. Nevertheless, we believe that responses from the interviews are useful in evaluating the need for medical screening and in identifying specific worker issues and concerns about the facility.

We interviewed workers whose main job tasks were carried out in the Waste Handling Building and/or in the Underground Storage Area. We also sought to interview workers represented by the major job categories. Those interviewed held the following positions:

- Electrician (surface)
- Electrician (underground)
- Radiological Control Technician-Control Handled Waste
- Radiological Control Technician-Remote Handled Waste
- Waste Handler-Remote Handled Waste
- Waste Handler-Contact Handled Waste
- Shaft and Opening Maintenance

- Miner
- Underground Mechanic
- Underground Rover

Worker responses reflected the following themes:

- Almost all participants who work underground reported that they do so frequently (at least once a week).
- Overall, the self-identified job titles of workers were identical or very similar to the job titles on the job function analysis (JFA) worksheets provided to us by site management.
- The majority of participants whose job tasks require that they work underground are exposed to salt dust, diesel exhaust particulates, "odors," and noise.
- Exposure to salt dust was near constant while working underground.
- Many workers expressed concern that monitoring for CCl_4 was done only before work on the bulkheads began. Since monitoring is not continuous, workers are concerned that limits exceed standards at times after initial sampling occurs.
- Most of the participants were not sure whether they had been exposed to CCl_4 or other solvents, because they were not trained to identify these substances. Several interviewees assumed that what they smelled was CCl_4, because they had been informed that it was present in the waste.
- Shaft and Opening Maintenance work includes welding where workers are exposed to welding fumes.
- Radiological Control Technicians (CH-Waste) and Waste Handlers (CH-Waste) report that they are exposed to bursts of solvents when they "burp," or off-gas, the TRUPACTs in the Waste Handling Building.
- Many participants are concerned that there may be unidentified chemical hazards traveling with the solvents during the off-gassing from the canisters.
- Several participants reported incidents of "bad smells" that led to feelings of dizziness, weakness, and fatigue. They were unable to identify what substance caused the incident. One such incident occurred in a room downstream from a waste storage room when the ventilation was not functioning.
- There are multiple devices used for operations in the underground that run on diesel fuel.
- Participants reported that most of the time they do not wear respirators, although they are available.
- Overall, workers reported a high level of satisfaction with the use and availability of personal protective equipment. Common PPE includes hard hats, ear plugs, steel toe boots, long sleeve shirts, safety glasses, gloves. Supervisors consistently reviewed and mandated use of PPE.
- Participants who have technical tasks expressed the opinion that the current sampling strategy is missing important exposure excursions, particularly of solvent vapors.
- None of the participants reported radiation dosimetry readings of concern, nor did any report uncontrolled exposure to non-ionizing radiation.
- Although dosimetry readings for ionizing radiation were low, some workers acknowledged they have concerns that they may be receiving greater doses than reported.
- Many workers who had experience in other mines in the area observed that the culture of health and safety is significantly better at WIPP than at private facilities.
- Most, though not all, workers felt that their health was not being adversely affected by their jobs at WIPP.
- The majority of those interviewed believe there would be an interest in a medical screening program for former workers at WIPP.

Below are sample responses of note:

- One worker reported his "equilibrium is occasionally off" and said he had spoken with other workers who have similar problems on an ongoing basis, suggestive of short term exposure to VOCs.
- One worker reported: "Most of us feel safe [working with radiation], but it is always in the back of your mind what you are actually working with."
- When asked about exposure to CCl4, one worker responded, "Sometimes I can smell it strongly. It is a strong smell, like a carburetor cleaner. It can take your breath away." He reported the smell on multiple occasions.
- One worker stated, "We don't know if the company is blowing smoke when they tell us its safe." He expressed concerns that CCl4 readings were taken before work started on the bulkheads, but not necessarily after.

E. Summary of Tasks and Potential Exposures of WIPP Workers

In general, workers at WIPP can be exposed to airborne contaminants in two ways: either they perform a task that generates the contaminant to which they are exposed, or they are present in an area where contaminant-generating work is being performed by someone else or where contaminants are generated by off -gassing from waste containers. Consequently, workers who work in the Underground Storage Area are potentially exposed to a range of chemical and physical hazards whether or not they are performing the tasks that generate the hazard. However, there is much evidence that shows that the degree of exposure varies with distance from the source of hazard generation and the time spent in the area. For instance, workers stationed on or near trucks that run on diesel fuel are potentially exposed to diesel exhaust regardless of the task they are performing.

Although ventilation is designed to capture process-related emissions as well as off-gassed contaminants, the alcoves and bends in the underground storage area may mitigate the ventilation's impact. Self-reports of VOC exposures from containers may result in part from the storage area's ventilation dead ends.

Based on the above considerations and a review of company job function analysis forms, we conclude that any worker who performed underground work at any time was potentially exposed to salt dust, DEP, noise and CCl_4. Job titles of exposed workers include:

- Electrician (underground)
- Waste Handler-Remote Handled Waste
- Waste Handler-Contact Handled Waste
- Radiological Control Technician-Control Handled Waste
- Radiological Control Technician-Remote Handled Waste
- Heavy Equipment Operator
- Underground Mechanics
- Miner
- Waste Hauler
- Welders
- Shaft and Opening Maintenance
- Underground Rover

Additionally, welders and shaft and opening maintenance are exposed to welding fumes.

V. Medical Screening for Former WIPP Workers

Based on the exposure characterization above, we have identified eight major potential exposures at WIPP that are known to have human health effects: salt dust, diesel exhaust, CCl_4, other volatile organic compounds (VOCs), welding fumes, , noise, radiation and lead (Table 2). Based on the prevalence of these health hazards that have existed over time at WIPP, we recommend a medical screening and surveillance program for all former workers at WIPP.

Table 2. Summary of WIPP hazards and key associated human health effects

HAZARD	**HEALTH EFFECTS**
Salt Dust	Lung function
Diesel Exhaust	Cardiovascular health, coronary artery disease, pulmonary disease, asthma, lung cancer
CCl_4	Liver function, kidney failure, nervous system, liver cancer
VOCs	Kidney function, liver function
Welding Fumes	Chronic bronchitis, pneumonia, emphysema, lung cancer
Noise	Hearing loss
Radiation	Leukemia, lymphatopoietic cancers and other cancers
Lead	High blood pressure, kidney disorders, neuropychologic impairment

Medical surveillance in the workplace is the systematic collection and evaluation of employee health data to evaluate specific instances of illness or health trends suggesting an adverse effect of workplace exposures, coupled with actions to reduce hazardous workplace exposures. Medical screening, which is a component of medical surveillance, is the administration of a medical test for the purpose of detecting organ dysfunction or disease in an asymptomatic person or before the person would normally seek medical care and at a time when medical intervention may be beneficial. Screening tests may indicate the presence of a disease or merely the higher probability of disease and often confirmatory tests are needed to evaluate the presence of disease after a screening test is performed.

According to these general principles, the tests employed for medical screening during Phase II should:

- lead to the early detection and therapy of disease and/or
- detect previously unrecognized health effects suspected on the basis of toxicologic and other studies.

In addition, we expect that screening results may be useful in providing some perspective on the adequacy of exposure control and other means of primary prevention for those employees still employed at WIPP. Summary information generated by this project will be provided to the WIPP medical director. In the design of the medical screening protocol, the general objectives of medical screening will be consistently evaluated by WHPP to ensure that a clinically relevant and cost-effective program is being carried out.

The selection of the screening tests derives directly from the exposure characterization that has been outlined above. Core screening tests will be administered to every participating cohort member based on the assumption that exposures to these hazards were potentially significant and may result in clinically detectable health effects. We recognize that some fraction of cohort members may not have been exposed to each hazard, but practicality and costs dictate that all core tests will be administered to all participants. Additionally, supplemental tests for CCl_4, and other VOC's will be offered to individuals based on their responses to specific questions in the exposure questionnaire.

Physical examination

A standardized physical examination will be performed on each participant to detect clinically relevant work-related conditions. The physical examination is not designed to be a comprehensive examination for purposes of general health screening, but rather will be focused on the potential health effects associated with the primary hazardous exposures as discussed above. The physical examination will include measurement of vital signs (blood pressure, pulse, respiratory rate); measurement of height and weight; examination of the skin, oropharynx, heart, lungs, abdomen; visual examination; and a screening neurological examination to detect cerebellar impairment, gait abnormalities, tremor, and/or peripheral neuropathy.

A licensed physician or nurse practitioner will perform all examinations. A medical screening protocol manual will be written for all clinical examiners to ensure uniformity of clinical examinations and criteria for follow-up and referral. Project physicians will be available by phone for the examining clinicians should there be questions or concerns during the screenings. Clinical providers will use the physical examination form which has been developed by project staff and used in other WHPP screening program. Project staff will instruct the clinical providers in its use in order to ensure consistent reporting.

In addition to a medical history, each participant will complete an occupational questionnaire. As with all potential occupationally-related disorders, a probing and thorough history of a person's past and current occupation highlighting what their jobs, job tasks, potential exposures, and history of work-related disease, is critical in making a determination about work-relatedness. We will utilize information gained from our site assessment in the questionnaire. All individuals currently smoking will be provided information about local smoking cessation programs and encouraged to quit. Where relevant, appropriate immunizations will be recommended.

The rationale supporting the administration of the core and supplemental tests will be presented below in Section B.

Core tests

The following tests will be administered to all participants.

- *Chest radiograph*: A radiograph of the chest will be obtained in the postero-anterior view. An initial plain film reading will be obtained by a certified radiologist followed by interpretation by a certified B reader according to the 2000 ILO International Classification of radiographs of Pneumoconiosis.

- *Spirometry*: A certified spirometry technician using established American Thoracic Society techniques will perform spirometry. Results will be interpreted based on a priori criteria for the evaluation of obstructive and/or restrictive findings.

- *Complete blood count with differential*: Laboratory phlebotomists will obtain one 5 cc blood specimen using standard venipuncture technique following the physical examination.

- *Hearing testing* (booth audiometry): Pure tone, air conduction, hearing threshold audiometry will be performed separately in each ear by a certified audiologist (Fellow of the American Academy of Audiology) using a soundproof booth. Test frequencies will include as a minimum 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz.

- *High Density Lipoprotein (HDL) and random glucose tests:* as well as the stool guaiac test to assess potential colorectal cancer.

Supplemental tests for selected participants based on exposure history

- *Blood biochemistry (including BUN, total bilirubin, alkphosphatase, creatinine, ALT, AST):*A blood sample will be collected as part of the same venipuncture as the CBC.

- *Blood lead:* A blood sample will be collected as part of the same venipuncture as the CBC.

B. Medical Tests - Rationale and Description

The exposures of concern in this targeted group are all associated with chronic disease outcomes, and our general approach is to recommend that all individuals in this high-risk group be eligible for a return evaluation within three years following their initial assessment. The nature and extent of the follow-up evaluation will be determined, in large part, by the information gathered at the first encounter.

The following section details health outcomes and our approach to specific testing and follow- up for illnesses related to each of the major hazards.

1. Salt Dust

a. Exposures and health outcomes

There is a dearth of quality peer-reviewed studies examining the health status of salt miners. Like most mining, the respiratory tract is the health endpoint of greatest concern for exposed individuals. In addition, safety-related issues are of paramount acute concern.

The WIPP facility involves continuous mining in halite (NaCl / sodium chloride / salt) deposits to create new storage space, and workers in the facility are exposed to a great deal of salt dust. It is possible that future waste depositories could be sited in similar formation. Salt dust is a potential risk with an unknown potential magnitude, particularly for cardiovascular, gastric and kidney diseases. There have been no studies performed of the health effects of occupational exposure to salt. It would be useful to perform a pilot medical evaluation of the workers in the WIPP facility to determine if they experience any health effects, in order to determine if they are adequately protected, and to inform assessment of risk for future waste depositories.

The respiratory tract may be a conduit for mined dusts, particle, fumes, and vapors. Size, shape, amount, and composition are important factors in assessing the toxicity of inhaled substances. The metal analysis of the salt dust provided to us by WIPP indicated that the measured levels were below the TLV for particulate not otherwise classified (PNOC). However, although the general health impact of salt dust

has been thought to be insignificant, recent studies suggest that there may be important and relevant health related changes following salt dust exposure.

Two recent studies by Backe et al. 2004 and Lotz et al. 2008 support previous work demonstrating the relationship between salt dust exposure and adverse respiratory outcomes. Backe et al. examined the lung function of salt miners in light of studies showing increased bronchitis and decreased lung function in workers exposed to salt dust. They found that the combined exposure of salt dust, diesel exhaust and nitrogen oxide appears to influence the immune system. Lotz et al. 2008, studied miners in two salt mines to assess the relationship between lung function and exposure. They found that mixed exposure can cause lung function disorders in salt miners. Salt, diesel exhaust, and nitrogen oxide concentrations were highly correlated making it difficult to determine the effects of a single exposure component. The salt dust data provided by WIPP was difficult to utilize. Although the exposure levels were below the TLV for PNOC, there were only four measurements provided. Based on observation during the site walk through and reports by workers, there is a near constant exposure to salt dust in the underground. Nonetheless, from the four measurements provided, one reading at 10.69 was essentially double the respirable dust standard of 5.0. Nuisance dust, if not respirable, may overload pulmonary defenses, e.g. macrophages, thereby inhibiting clearance activities.

b. Recommended tests

Chest radiograph and B-Reading

All former WIPP employees who worked in the underground facility should have a chest radiograph with B-reading. The presence of salt dust during any mining activities, even at measured levels one-half the PNOC TLV, supports the need for medical screening. For individuals with a history of workplace dust exposure, chest x-rays are part of medical testing procedures for dust-induced lung diseases, including the pneumoconiosis (e.g., silicosis and asbestosis). According to NIOSH web site's discussion of the Classification of Chest Radiographs: Practices for Medical Diagnosis (http://www.cdc.gov/niosh/topics/chestradiography/medical-diagnosis.html), while "the ILO classification is not necessary for medical diagnosis of pneumoconiosis … the ILO classification system can be useful in describing occupationally-induced abnormalities, if present. If pneumoconiosis is suspected, an ILO classification may eventually be required for participation in Federal or State compensation systems (State of Ohio 2004)."

Spirometry

Backe et al.'s observation about salt dust inhibiting immune function as well as decline in lung function, support the utilization of spirometric testing. In addition, the potential fibrogenic activity caused by components of salt dust, support utilizing chest x-rays and B-reading. Pneumoconiosis are caused by inorganic dusts or fibers. The pathology in the lung is fibrosis, proliferation of fibrous tissue between the alveoli which interferes with the normal expansion of the lungs. With continued exposure, the fibrosis increases, leading to shortness of breath and a persistent cough, and, in late stages, heart failure. Spirometry is useful in that it can assist in detecting early physiologic changes due to dust-related lung diseases and it can help establish the extent of a pulmonary abnormality.

c. Follow-up:

Individuals with abnormal tests will be referred to their primary provider. Recommend repeat chest radiograph and spirometry every three to five years at an interval consistent with FWP screening protocol, depending on exposure history.

2. **Diesel Exhaust**

a. Exposures and health outcomes

Diesel exhaust consists of many components including (1) carbon monoxide and carbon dioxide; (2) nitrogen oxides; (3) sulfur oxides; (4) hydrocarbons; (5) unburned carbon particles (soot); and (6) water. Exhaust from diesel engines contributes approximately 1/2 of ambient particulate that are less than 10 μm (PM10). It also contributes to fine particulate matter that is less than 2.5 μm (PM2.5) and ultra-fine particles with a diameter below 0.1 μm. These particles are small enough to be inhaled and deposited in the lungs. Organic compounds from diesel exhaust with known toxic and carcinogenic properties, such as polycyclic aromatic hydrocarbons (PAH), adhere easily to the surface of the particulate and are carried deep into the lungs. Diesel exhaust contains other toxic substances including nitrogen oxides, sulfur oxides, ozone, formaldehyde, benzene, and smaller organic molecules.

Diesel exhaust particulate (DEP) exposure is associated with an increased risk of cardiovascular disease and death. DEP induces heart rate variability, ventricular arrhythmia, a significant decrease in left-ventricular systolic pressure, and an increase in left-ventricular end-diastolic pressure in animal models and has been shown that DEP produces superoxide radicals, which cause irreversible myocardial damage leading to cardiac arrest.

Studies of heavy equipment operators (Finkelstein et al. 2004) demonstrated that DEP is a factor in development of coronary artery disease. Finkelstein, after controlling for smoking, reported higher incidence of ischemic heart disease in heavy equipment operators chronically exposed to DEPs.

Many substances in diesel exhaust, such as ozone, can contribute to lung damage. Many of the hydrocarbon molecules emitted by diesel engines, such as PAH, are toxic to the lung. Studies have found that living in areas with elevated DEP levels increases the risk of pulmonary disease and decreases the rate of lung growth. In addition, long term exposure to DEPs has been shown to be associated with an increased risk for the development of asthma.

A 2003 pathology study by Churg et al. compared the lungs of Mexico City inhabitants to those of Vancouver, Canada residents. Mexico City has a relatively higher concentration of DEP and it was found that the lungs of the Mexico City inhabitants were significantly more diseased.

Workers in enclosed spaces such as mines and ships are especially at risk from DEP-induced pulmonary disease. Jorgensen and Svensson, in 1970, reported that underground miners had productive cough and frequent respiratory infections and in 1993 Wade and Newman attributed asthma in train crews to diesel exhaust.

In 1989, the International Agency for Research on Cancer (IARC) concluded that there is sufficient evidence for the carcinogenicity of diesel exhaust in experimental animals but limited evidence for carcinogenicity in humans. In 1990, California identified diesel exhaust as a substance known to cause cancer. Numerous diesel constituents have been shown to damage DNA and lead to cancer in several animal lung studies. Occupational studies of railroad workers (Garshick et al. 2004), heavy equipment operators and truck drivers (Jarvholm and Silverman 2003) have demonstrated a significantly higher-than-normal incidence of death from lung cancer.

b. Recommended tests

Chest radiograph

Although chest radiography may detect lung cancer, there is no evidence in population-based chest x-ray screenings, that screening will improve clinical outcome. However, a chest radiograph will be performed for detection of dust-related interstitial lung disease. It is reasonable to assume that exposure to diesel exhaust poses a risk of lung cancer greater than that associated with either exposure alone. In selected cases, the detection of an occult lung carcinoma on chest x-ray may allow for early treatment with improved prognosis.

Early lung cancer screening using low-dose CT scans has been demonstrated to significantly reduce lung cancer mortality (National Lung Screening Trial Search Team 2011). The DOE Former Worker Program has recommended its use in its screening programs. We will consider its use in individuals with relevant work and demographic risk-factors. A more complete elaboration of early lung cancer screening recommendations for this cohort will be made after screening data is collected on former workers.

Spirometry

Backe et al.'s observation about salt dust inhibiting immune function as well as decline in lung function, support the utilization of spirometric testing. In addition, the potential fibrogenic activity caused by components of salt dust, support utilizing chest x-rays and B-reading. Inorganic dusts or fibers cause pneumoconiosis. The pathology in the lung is fibrosis, proliferation of fibrous tissue between the alveoli which interferes with the normal expansion of the lungs. With continued exposure, the fibrosis increases, leading to shortness of breath and a persistent cough, and, in late stages, heart failure. Spirometry is useful in that it can assist in detecting early physiologic changes due to dust-related lung diseases and it can help establish the extent of a pulmonary abnormality.

c. Follow-up

Individuals with abnormal tests will be referred to their primary provider. Recommend repeat chest radiograph and spirometry to screen for COPD and dust-related lung disease every three to five years, an interval consistent with FWP screening protocol, depending on exposure history.

3. CCl_4

a. Exposures and health outcomes

CCl_4 is the predominant VOC present in the waste and is found in sludge from Idaho and Rocky Flats, where it was used as a cleaning agent. It is emitted from containers that hold such sludge, and reaches high concentrations in underground sealed panels where waste containers have been emplaced. It has also been reported that emissions of CCl_4 may be released when TRU-Pact containers are opened in the Waste Handling Building. Currently CCl_4 is continually monitored for compliance with occupational health and environmental regulations.

CCl_4 exposure at WIPP is likely to occur when TRUPACTs are opened and workers are in the Waste Handling Building. In addition, workers are potentially exposed in underground storage areas, particularly in poorly vented areas. Exposure most likely occurs via inhalation but dermal contact is also possible.

CCl_4 is a clear liquid that evaporates very easily and mostly is found as a gas. It has a sweet odor, and most people can detect its smell in air when the concentration reaches 10 ppm. It has been produced in large quantities to make refrigeration fluid and propellants for aerosol cans. In the past, CCl_4 was widely used as a cleaning fluid in industry, in dry cleaning establishments as a degreasing agent, and in households as a spot remover for clothing, furniture, and carpeting.

CCl_4 can be absorbed through the lungs or through the gastrointestinal tract. It can also be absorbed through the skin. When CCl_4 is absorbed, most of it temporarily accumulates in body fat and then a portion goes to the kidney, liver, brain, lungs, and skeletal muscle.

The liver is especially sensitive to CCl_4 since it is where the enzymes that degrade CCl_4 are located. Some of the breakdown products may attack liver proteins, interfering with cell function potentially resulting in the death of the cells. In mild cases, the liver may become swollen and tender. In severe cases, liver cells may be damaged or destroyed, leading to a decrease in liver function and fibrosis.

The kidney is also sensitive to CCl_4. Less urine may be formed, leading to a buildup of waste products in the blood. In individuals with acute high exposure, kidney failure often was the main cause of death. Fortunately, if liver and kidney injuries are not too severe, these effects eventually disappear after exposure stops. This is because both organs can repair damaged cells and replace dead cells

After exposure to high levels of CCl_4, the nervous system, including the brain, is affected. Such exposure can be fatal. The immediate effects are usually signs of intoxication, including headache, dizziness, and sleepiness perhaps accompanied by nausea and vomiting. These effects usually disappear within 1-2 days after exposure stops. In severe cases, stupor or even coma can result, and permanent damage to nerve cells can occur.

Chronic inhalation animal studies have demonstrated increased frequency of liver tumors. Mice breathing CCl_4 also developed tumors of the adrenal gland. The Department of Health and Human Services (DHHS) has determined that CCl_4 may reasonably be anticipated to be a carcinogen (i.e., cause cancer). The International Agency for Research on Cancer (IARC) has classified CCl_4 in Group 2B, possibly carcinogenic to humans. EPA has determined that CCl_4 is a probable human carcinogen.

CCl_4 (and other VOC's) have been identified as an exposure of concern by many current workers. Monitoring studies (see above) note its presence although the degree of risk is difficult to determine from the available data. Nevertheless, medical monitoring tests should be conducted based on the concerns and exposure related complaints highlighted by current workers as well as the potential risk suggested by the monitoring data.

b. Recommended tests

Liver function studies (ALT, AST, Total Bili, Alkaline Phosphatase)

The Liver function tests (LFT's) are sensitive but non-specific markers of liver injury and may be affected by many environmental factors including chlorinated solvents as well as viruses and alcohol consumption. LFT's apply to a variety of blood tests that assess the general state of the liver and biliary system. Tests used in this project are markers of livers or biliary tract disease, such as the various liver enzymes. There are two general categories of "liver enzymes." The first group includes the alanine aminotransferase (ALT) and the aspartate aminotransferase (AST), which are enzymes that indicate liver cell damage. The other frequently used liver enzyme is the alkaline phosphatase that indicates obstruction to the biliary system, either within the liver or in the larger bile channels outside the liver. Bilirubin is the main bile pigment in humans that, when elevated, causes the yellow discoloration of the skin and eyes called jaundice. The bilirubin may be elevated in many forms of liver or biliary tract disease, and thus it is also relatively nonspecific. However, serum bilirubin is generally considered a true test of liver function, since it reflects the liver's ability to take up, process and secrete bilirubin into the bile.

Kidney function studies (creatinine, BUN)

Kidney function can be assessed by measuring the plasma concentrations of the waste substances of creatinine and urea. These measures are adequate to determine whether a patient is suffering from kidney disease. However, blood urea nitrogen (BUN) and creatinine will not be raised above the normal range until 60% of total kidney function is lost. These tests should be offered to people who were exposed to CCl_4 within the last ten years.

c. Follow-up

Individuals with abnormal tests will be referred to their primary provider.

4. Other volatile organic compounds (VOCs)

a. Exposures and health outcomes

As with CCl_4, VOCs are present in the waste and are found in sludge from Idaho and Rocky Flats, where they were used as a cleaning agent. They are emitted from containers that hold such sludge, and are found in underground sealed panels where waste containers have been emplaced. It has also been reported that emissions of VOCs may be released when TRU-PACT containers are opened in the Waste Handling Building.

VOC's are commonly used for cleaning, degreasing, thinning, and extraction. They are also used as intermediates in the manufacture and formulation of chemical products. Solvents comprise a group of volatile hydrocarbon liquids, some of which are halogenated. As a group, solvents are heterogeneous including aliphatic, aromatic, and alicyclic compounds, as well as alcohols, ketones, esters, and ethers. Solvents are known to be acutely neurotoxic, with kidney and liver damage possible after longer term exposure. Exposure to solvents can occur via inhalation of vapors and through dermal exposure. Solvent that is not eliminated through exhalation is bio transformed into metabolites that are excreted. A common route involves the liver and microsomal P-450 enzymes with final metabolites that are water soluble and excreted via the kidneys in the urine.

b. Recommended tests

Liver function studies (ALT, AST, Total Bili, Alkaline Phosphatase)

See above for CCl_4.

c. Follow-up:

Individuals with elevated liver enzymes will be referred to their primary care provider for additional evaluation.

5. Welding Fumes

a. Exposures and health outcomes

Welding fumes are generated during welding operations performed in the underground mechanics shop and during construction of bulkheads. Metal fumes are produced during the welding operations. The fume composition depends primarily on the base metal being joined and the composition of the stick being used. However, the task at WIPP is overwhelmingly stick welding of mild steel. The following metals, with known human health effects, have been identified in ambient air personal monitoring

samples: antimony, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, vanadium and zinc.

Welding fumes are absorbed through the lungs. Exposure to different types of welding fumes produces different health effects. Short-term effects tend to irritate the upper airways and mucous membranes and can include irritation of the eyes, nose, and chest, as well as coughing, shortness of breath, and bronchitis. Long-term exposure to the gases, fumes, and vapors generated from welding can result in chronic bronchitis, pneumonia, emphysema, and lung cancer.

b. Recommended tests

See above for diesel exhaust

c. Follow-up

Individuals with abnormal tests will be referred to their primary provider. Follow-up exams are to be performed every three years, an interval consistent with FWP screening protocol.

6. Noise

a. Exposures and health outcomes

As mentioned above, personal noise exposure measurements were made at least since 1990. They demonstrate a great range of exposures. However, there are considerable measurements above the OSHA PEL of 90 dBA. 22% of full-shift measurements were ≥ than the OSHA PEL of 90 dBA and 16 measurements were ≥ 100 dBA. Fifty-Nine (14.6%) measurements were ≥ the OSHA Action Level of 85 dBA. Dosimetry levels in excess of 85 dBA occur in a variety of jobs and different underground work locations. All individuals who worked underground should get audiometric screening.

The risk of developing a material impairment becomes significant over a working lifetime when workplace exposure exceeds average sound levels of 85 dBA. MSHA's rule contains criteria for the diagnosis of Noise Induced Hearing Loss (NIHL) and provides recommendations for testing. It defines material impairment of hearing as "a permanent, measurable loss of hearing which, unchecked, will limit the ability to understand speech, as it is spoken in everyday social (noisy) conditions (Department of Labor 1997)." MSHA has adopted the OSHA/NIOSH criteria, relating the results of audiogram measurements to a measurable hearing loss, as a means of determining risk estimates for miners. The criterion describes material impairment as a 25 dB loss in hearing ability averaged over the measurements at the frequencies of 1000, 2000, and 3000 Hz.

b. Recommended test

Pure tone audiometry

The Occupational Noise Exposure-Hearing Conservation Amendment, part of issue 29 of the Federal Register, requires that workers exposed to an 8-hour time-weighted average of 85 dBA or more have their hearing assessed through pure-tone audiometry. Additionally, in 1996, MSHA published the proposed rule "Health Standards for Occupational Noise Exposure in Coal, Metal, and Nonmetal Mines," (30 CFR Parts 56, 57, 62, 70 and 71). Sec. 62.150 specifies that audiometric tests shall be pure tone, air conduction, hearing threshold examinations, with test frequencies including as a minimum 500, 1000, 2000, 3000, 4000, and 6000 Hz. Each ear shall be tested separately.

c. Follow-up:

The follow-up recommendation will be individually based following a review of the screening audiogram.

7. Radiation

a. Exposures and health outcomes

Ionizing radiation is present in all waste shipped to the WIPP facility. Although the dose history records provided to us did not show excessive exposures to radiation at WIPP (See Appendix A) , the majority of the workforce operates in close proximately to ionizing radiation and there is a near constant concern of exposure risk.

We recognize that exposures to ionizing radiation at WIPP are low and that the cancer risk associated with this exposure is difficult to be accurately estimated. Although the recorded dosimetry levels at WIPP are low, we believe that ionizing radiation-related health effects (cancer) remain a potential risk for the WIPP cohort for the following reasons.

1. The 2006 National Research Council's committee on *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2* based its report on the Linear No Threshold Dose-Response Model for which any dose greater than zero has a positive probability of producing an effect (*e.g.,* mutation or cancer). While experts disagree over the definition of "low dose," radiation protection measures are based on an assumption that even small amounts of radiation exposure may pose some small risk.

We do understand that the above assumption is a conservative because health effects have not been observed at doses lower than 10 rem (0.1 Sv). However, the possibility of cancer increase cannot be dismissed.

2. BEIR VII report defines "low dose" as doses in the range of "near zero up to about 100 mSv (0.1 Sv) of low-LET radiation". In addition, the annual worldwide background exposure from natural sources of low-LET radiation is about 1 mSv (100 mrem).

As stated in the BEIR VII report, the committee has developed most up-to-date and comprehensive risk estimates for exposure to low-dose, low-LET radiation in humans. The committee did model cancer risk from a single exposure of 0.1 Sv (10,000 mrem). Based on the BEIR VII lifetime risk model it is estimated that approximately 1 person in 100 would be expected to develop cancer (solid cancer or leukemia) from a dose of 0.1 Sv (above background) while approximately 42 of the 100 individuals would be expected to develop solid cancer or leukemia from other causes. The BEIR VII committee also noted that lower doses would produce proportionally lower risks. For example, they estimated that approximately one person per thousand would develop cancer from an exposure to 0.01 Sv (1000 mrem). Again, this estimate is based on the assumption that risk continues in a linear fashion at lower doses without a threshold and that the smallest dose has the potential to cause a small increase in risk to humans. Although the risk estimates are uncertain due to data limitations used to create the risk models, low-dose studies are unlikely to precisely quantify cancer risks in humans at doses much below 10 mSv. However, the majority of information indicates that there will be some risk, even at low doses, although the risk is small.

With that said, it is our assessment/belief that there is a finite excess cancer risk, albeit a small one, that can result from exposures above background such as experienced at WIPP. It is for that reason that we recommend the use of a complete blood count (CBC) as a screening test. We recognize the limitations of this test and the great deal of uncertainty surrounding excess risk as such low dose levels.

Additionally, epidemiologic studies of workers in the nuclear weapons complex in the U.S. and other countries strongly suggest that radiation exposure (both external and internal) is associated with an increased risk of dying from leukemia and lymphatopoietic cancers. Other worker studies have suggested an increased risk of brain cancer associated with exposure to plutonium, an increased risk of thyroid cancer has been found among residents exposed to radioactive isotopes from atmospheric testing, and a recent study of Chernobyl emergency workers suggests possible excess cases of thyroid cancer.

b. Recommended tests

Complete blood count with differential**.**

The complete blood count (CBC) with differential cell count remains the only (albeit crude), easily obtainable measure of hematogical effects due to radiation. Screening for hematologic carcinogens continues to rely on the complete blood count and differential testing. Although the CBC is useful for the evaluation of individuals with symptoms suggestive of hematological malignancy, early detection of these cancers has not been shown to alter prognosis. For purposes of medical screening, the inclusion of the CBC with differential will be used primarily to detect cases of undiagnosed hematological malignancy.

c. Follow-up:

A lifetime follow-up is necessary to assess the full health burden of ionizing radiation exposures in populations like the WIPP high-risk group. The CBC should be performed every three years.

8. Lead

a. Exposures and health outcomes

Occupational exposure to lead at the WIPP facility may occur at the firing range where security personnel practice use of weapons. Lead dust can accumulate in such areas and become airborne due to disturbance of surfaces by vehicular and foot traffic and by movement of air. Although lead exposure data provided by the site did not exceed the OSHA PEL, studies of comparable populations suggest that lead levels generated may represent a potential health risk for security personnel (Tripathi et al. 1991).

Lead and many of its adverse health outcomes have been known for centuries and are relatively well understood. However, recent research has demonstrated that adverse health effects from lead are being observed at lower and lower blood lead levels. Lead exposure can result from inhalation of dust or fumes in addition to ingestion of lead contaminated items; dermal absorption does not occur. Once absorbed, lead distributes through the bodies tissues including blood, allowing for a blood lead level test to assess exposure. Acute exposure in high enough doses is extremely toxic. Chronic long term exposure can result in lead poisoning, nervous system damage, weakness, tremors, irritability, confusion, constipation, high blood pressure and reproductive effects (CDC/NIOSH 2007).

b. Recommended tests

NIOSH recommends a complete blood count (CBC) and blood pressure for lead exposure screening (CDC 2005). All participants are given a physical exam and a CBC with differential, those who have had lead exposure in the past five years will have their blood lead level measured. This is a

measure of absorbed lead but it cannot assess chronic lead exposure. Follow-up blood lead levels and/or other lab tests may be recommended for any former worker identified with an elevated blood lead level at the time of screening (Pepper 2006).

c. Follow-up

The follow-up recommendation will be individually based following a review of the initial blood lead.

VI. Plan for Implementation of Medical Screening Program to Former WIPP Workers

Medical screening for former WIPP workers will be provided by occupational medicine providers located in the Carlsbad and Albuquerque areas. All physicians and clinical sites will be certified by the WHPP program, see Attachment 2 for credentialing form. It is hoped that there will be ample screening locations so that the majority of those wishing to participate will be able to easily access a screening facility.

The screening sites will offer a standardized protocol that will be determined by the Queens College WHPP program and which will comport with the screening guidelines established by the DOE Former Worker Program (Attachment 3).

Once the Phase I report has been reviewed and approved, the WHPP will contact medical groups and establish program contracts. Once contracted, each medical group will have participants scheduled by the Queens WHPP office. Medical forms and informed consents will be provided by Queens and returned to the WHPP along with copies of the chest x-ray report, chest x-ray, spirometry, and audiometry.

Individual participants who do not live close to a clinical location will be referred to the National Supplemental Screening Program, another component of the DOE FWP which provides medical screening exams to former workers from DOE sites served by an FWP program but who no longer live near the screening clinics.

VII. Worker Notification

Overview

WHPP program staff will develop an outreach plan based upon previous success at our other nine facilities. Outreach will consist of 1) creating employee notification materials to both alert former workers of the availability of the program and to highlight the potential hazards identified on site which may lead to occupational illness and; 2) if the budget allows, hiring a former WIPP employee as a local site coordinator who will work offsite and will assist with outreach efforts.

Notification materials will include program brochures, posters, newspaper advertisements, invitation letters and press releases to be distributed to former workers and in other visible areas in the local community. Additionally, digital media such as Google Ad Words and the WHPP program website will be updated to include the information for the screening program at WIPP. All materials will be approved by QC and DOE institutional review boards.

Direct notification of workers will be done through the utilization of employee rosters. WIPP site management will be providing WHPP with these rosters of former WIPP workers. These rosters may contain names, addresses, social security numbers, date of birth, phone numbers, years worked, job titles or other data fields. WHPP will engage the commercial services of Trans Union credit agency to update contact information. Trans Union has been authorized, following DOE- approved protocol to securely

update missing or outdated contact information fields and to provide the most current addresses and phone numbers for these workers.

When updated contact information is obtained, WHPP will send program literature directly to former workers, inviting them to participate in the program. Additionally, WHPP staff will make follow-up phone calls following an IRB- approved script in order to provide additional information and address any questions that the former workers may have.

WHPP will partner with local USW union members for assistance with outreach where appropriate. If funds allow, WHPP will hire a former union member to act as a local site coordinator or ground team. This worker advocate serves as the face of the program and performs a multitude of functions, including: identifying, locating and enrolling participants in the program; hosting and participating in outreach opportunities in the community; reaching out to local media; administering the program's satisfaction surveys; and serving as a resource to workers and their families on issues relating to EEOICPA and state worker's compensation programs. The local coordinator will provide invaluable local visibility for WHPP and inspire trust and credibility among participants.

Additionally, WHPP will work with the site contractor to ensure employees are notified of the program during their exit interviews and are given program information with their exit packages.

Estimated Population of Former Workers

As of February 2011, there are 733 employees of both the prime and subcontractors at WIPP (Project Staff 2011). This is in contrast to a reported peak in 1993 of 1,077 (Kidder 1999). The WIPP human resources department has estimated a small turnover rate of approximately one-percent per year (Project Staff 2011). Taking into account the difference in peak employment versus the current workforce and estimating the one-percent turnover per year based on the difference between these numbers, we expect the former worker population to be approximately 534. We anticipate an additional 8 workers exiting per year, with a much greater increase in exiting workers when the facility begins to reach capacity and receiving operations cease within the next five to ten years.

Although waste was not handled on-site until 1999, beginning in 1990, the majority of job titles were filled and mining operations were conducted. Since we have characterized hazards such as salt dust, diesel exhaust and noise, which exist at WIPP independent of hazardous waste, we estimate that the entire non-construction work force post-1990 fall into the cohort of workers eligible for medical screening.

Until rosters are obtained and address update services are utilized, we cannot be certain of the current location of former workers. Based on discussion with current workers, we estimate 50% of former workers remain in the local area after exiting WIPP. Former workers who live outside of the Carlsbad area and express interest will be referred to the National Supplemental Screening Program.

VII. Summary

The results of this Phase I assessment support the need for a medical screening program. This conclusion is based on the evidence that many workers had exposures to hazardous substances and processes and the desire expressed by interviewed workers for a program of medical screening and education that's targeted to the risks and hazards WIPP workers have experienced.

In Phase II, we propose to develop and implement a health protection and risk communication program for WIPP workers centered on the workers at risk for 1) chronic respiratory disease, including chronic obstructive lung disease (COPD) and the pneumoconioses, 2) kidney, liver and neurologic disease, and 3) hearing loss. We select these conditions, because they meet the criteria established by the DOE for medical monitoring and risk communication. Our logic is two-fold. First, these diseases are

caused by exposures that have occurred at WIPP. Second, a medical screening program framed around these conditions can provide tangible benefits. It can lead to early detection of chronic disorders, which can increase survival and quality of life. A well-designed program can identify COPD and the pneumoconioses for which advice about proper treatment , vaccinations, and prompt treatment of superimposed infections will be highly beneficial.

Early lung cancer screening using low-dose CT scans has been demonstrated to significantly reduce lung cancer mortality. The DOE Former Worker Program has recommended its use in its screening programs. We will consider its use in individuals with relevant work and demographic risk-factors. A more complete elaboration of early lung cancer screening recommendations for this cohort will be made after screening data is collected on former workers

Although screening for early lung cancer detection is not an outcome of this program, lung cancer risk among program participants can be alleviated by encouraging participants with a smoking history to take part in smoking cessation programs. In addition, the severity of kidney, liver, and neurologic disease can be reduced by control of other risk factors (e.g. – hypertension and alcohol consumption) that are identified during the screening program.

The worker notification component will be a centerpiece of a health protection/medical monitoring program. While there remains considerable uncertainty about the health risks experienced as a result of working at WIPP, this uncertainty must be openly communicated by credible sources. In combination with a medical screening program designed to protect health, accurate information about risks will be itself health promoting. We propose the hard outcomes noted above for medical monitoring, in part, because they can be identified with certainty. The health outcomes that we seek to include a monitoring program are highly amenable to screening on a population basis. After participation in the screening program, former and current WIPP workers will have increased real knowledge about their personal health status, what is known about their risks, and how they can promote their own health. In conclusion, mounting such a program in Phase II should make a tangible improvement in people's lives.

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Appendix

Waste Isolation Pilot Plant Worker Dose History by Year, Maximum Individual dose, and Average measurable dose

All total effective dose (TED) in rem

WIPP Year	Collective TED (person-rem)	Number with measurable TED	Average measurable TED (rem)	Max individual TED (rem)	Number of individual monitored
1999	0.331	20	0.017	0.039	404
2000	0.132	8	0.017	0.031	522
2001	1.103	60	0.018	0.065	558
2002	2.298	89	0.026	0.092	603
2003	1.147	76	0.015	0.050	647
2004	1.214	80	0.015	0.055	612
2005	1.124	72	0.016	0.042	662
2006	1.352	87	0.016	0.060	678
2007	1.721	105	0.016	0.048	856
2008	1.069	63	0.017	0.041	956
2009	0.909	68	0.013	0.037	1116
2010	1.199	62	0.019	0.101	1092

Note #1: The first three cloumns of worker dose history is published by DOE REMS Program under HS-20 and can be accessed at:
http://www.hss.energy.gov/sesa/Analysis/rems/annual.htm

Note #2: The average measurable TED is the result of Column B/Column C and to provide info on the average measurable dose for workers in a given year.

Note #3: The Cloumns E and F are additional information provided by WIPP Project to allow the evaluation of maximum worker dose received in a given year and its monitoring size.

Attachment 1

Job Exposure Telephone Interview Questionnaire for Worker Health Protection Program Phase I Needs Assessment at the Waste Isolation Pilot Plant (WIPP)

Date ___/___/____

Interviewer will read:

My name is Mark Goldberg/Jonathan Corbin and I am working with the Worker Health Protection Program to describe the potential hazards associated with working at the WIPP facility. I will ask you questions about work locations, work tasks, etc. (fill in). Your answer should reflect your best recollection of your experience at WIPP. If you do not recall or if the question is not applicable to you, please let us know.

Before we begin the interview, I need to ask you if you have received and read a copy of the informed consent form that was mailed to you ? ___yes ___no

If no, I will read the contents of the informed consent to you now. (Interviewer to read attached copy of informed consent)

Do you agree to the conditions of participation outlined in the informed consent? You may ask as many questions as you would like about the informed consent prior to answering. ___yes ___no

If no, we will cannot complete the interview, I thank you for your time.

If yes, we will now begin the interviewrelated to your work at WIPP.

1. Are you presently employed at WIPP? ___ Yes ___No

2. Job History

Interviewer will read:

Please identify every job title that you have hadat the WIPP facility and the start and end dates of each job.

Job Title	**Start Date**	**End Date**
Electrician Surface		
Electrician Underground		
Radiological Control Surface		

Radiological Control Underground		
Waste Handler Surface		
Waste Handler Underground		
Shaft Crew Welder Surface		
Shaft Crew Welder Underground		
Miner		
Other (Specify)_____		

3. Job Locations

Interviewer will read: *I will ask you to identify which locations you performed your job duties as a*

_____

Location	Frequently (3-5 days per week)	Sometimes (1-2 days per week)	Rarely (1-2 days per month)	Never
Waste Handling Building				
Underground Storage Facility				
Shops _____				
Other (specify) _____				

4. Job Tasks

Interviewer will read: *I will now ask you to describe the major processes or operations during your job as a _____Additionally, I will ask how often you performed these tasks.*

Task Description	Frequently (3-5 days per week)	Sometimes (1-2 days per week)	Occasionally (1-2 days per month)	Rarely (less than 1 day per month)	Never

5. Chemical or Agent Exposures

Interviewer will read: *I will now ask you to identify which potential hazards you may have worked with or aroundduring your job as* a _____

Chemical or Agent	Frequently (1 or more times per week)	Sometimes (1 or more times per month)	Never	Don't know
Carbon Tetrachloride				
1.1.1.Trichloroethane				
Other Volatile Organic Compounds				
Welding Fumes				
Diesel Exhaust Particulate (DEP)				
Salt Dust				
Lead Dust				
Noise				

Ionizing Radiation				
Other _____				
Other _____				

6. Radiation

Interviewer will read: *I will now ask some questions related to ionizing radiation exposure.*

6.1 While working as a _____, did you ever handle or work with ionizing radiation from radioactive materials or a radiation-producing device? ____Yes ____No ____Not Sure

6.2 Did you wear a dosimeter? ____Yes ____No

If Yes, **If No, skip to question 6.3**

6.2.1 During which year(s)? _____

6.2.2 Where were you working? _____

6.3 Were there times when you did not wear a badge/dosimeter?

____Yes ____No

6.4 Did your dosimeter ever read a positive dose for radiation exposure?

____Yes ____No

If Yes, **If No, skip to question 7**

6.4.1 How many times? _____

6.4.2 During which year(s)? From_____ To:_____

Year Year

6.4.3 Where were you working? _____

7. Areas of concern

Interviewer will read:

Describe other information of interest or concern during your time as a _____. (This can include accidents, incidents, information regarding the changes that took place over time within the building or any other information you believe to be of interest or concern.)

8. Personal Protective Equipment

Interviewer will read:

Describe the use of Personal Protective Equipment (PPE) used in tasks described in your job as a _____. Summarize any changes in requirements and practices over time.

9. Do you have any medical concerns related to your work at the WIPP facility? Please explain.

10. Do you believe there is an interest in a medical screening program at WIPP?

Attachment 2

WORKER HEALTH PROTECTION PROGRAM (WHPP)
MEDICAL FACILITY INFORMATION

A. Each MEDICAL FACILITY should submit to the Steelworkers via CBNS/ Queens College:

1) Proof of current facility Liability Insurance policy;
2) Proof/copy of Business Registration
3) List of names of all physicians/physician assistants participating in the Steelworkers WHPP:

In addition to submitting these items, each **MEDICAL FACILITY** should:

1) Agree that, anytime a new physician/physician assistant is added to the list of those participating in the Steelworkers WHPP, all the documentation listed below, as well as all Physician Statement forms, should be sent to CBNS/Queens College.
2) That the Steelworkers WHPP Screening Office at CBNS/Queens College will be notified by telephone of any such additions to the list of participating physicians/physician assistants;
3) Steelworkers WHPP and CBNS/Queens College reserves the right to reject individuals considered unqualified for the program.

B. **Each participating PHYSICIAN/PHYSICIAN ASSISTANT should submit to the Steelworkers, via CBNS/Queens College:**

1) Current CV
2) Current Medical License*
3) Original Medical Diploma (copy)
4) Current Registration*
5) Board certification, preferably in Primary Care* (Family or Internal Medicine)
6) Proof of malpractice insurance coverage*
7) Workers Compensation rating* (if applicable)
8) Submit a report from the National Practitioner Data Bank by self querying the bank at **www.npdb-hipdb.hrsa.gov**. The information contained in the report will be used for the credentialing of the provider. An updated report is required with the two year re-credentialing package as well as after any disciplinary action the provider may have received.*

You are required to submit current copies of these documents to Queens College when they are renewed.

In addition to submitting these items, each participating PHYSICIAN should:

1) Be aware of the worker notification, referral, and confidentiality protocols of the Steelworkers WHPP and CBNS/Queens College, and be familiar with the terms of the contract between the Steelworkers WHPP and CBNS/Queens College and the medical facility at _____;

2) Complete and return to the Steelworkers WHPP Screening Office at CBNS/Queens College the following forms

   a. Physician Information

   b. Release of Information Agreement

   c. Confidential Physician Statement

Steelworkers Worker Health Protection Program and CBNS/Queens College

PHYSICIAN INFORMATION

This form should be typed or legibly printed in black ink. If more space is needed, attach additional sheets and reference the question.

Physician Name: _____

_____

Last First MI M.D., D.O., P.A.,Other

_____ _____ _____ _____

Date of Birth Sex: F, M State Medical License # State

For urgent consultation, I can be reached at:

_____ _____ _____

Telephone *Pager* *Other*

Please attach copy of certificate(s).If you are not Board Certified in your specialty, please attach a full description of your training and experience in the specialty. If Board Admissible, note date expected to complete Board Certification.

Specialty: _____

Board Status: ☐ Certified ☐ Recertified

Name of Specialty Board:_____ Certificate # _____ Date:_____

Subspecialty:_____

Board Status: ☐ Certified ☐ Recertified

Name of Specialty Board:_____ Certificate # _____ Date:_____

I warrant that all of the statements made in this statement and on the attached forms are true and correct. I understand that any material misstatements in, or omissions from, this statement constitute cause for denial of membership or cause for summary dismissal from the Steelworkers Worker Health Protection Program. I am aware of the worker notification, referral, and confidentiality protocols of the Steelworkers WHPP, and am familiar with the terms of the contract between the Steelworkers WHPP and the medical facility at _____.

_____ _____

Signature Date

_____

Printed Physician's/Physician Assistant's Name

Release of Information Agreement

This agreement allows for the collection of information to evaluate my application for participation with the Steelworkers Worker Health Protection Program, and throughout the duration of any service contract between the Steelworkers Worker Health Protection Program and me. This authorization will be used to obtain information for ongoing evaluation, and recredentialing. I understand that any material misstatements in, or omissions from, this application constitute cause for denial of participation or cause for summary dismissal from the Steelworkers Worker Health Protection Program.

I authorize the Steelworkers Worker Health Protection Program, its agents and employees, to consult references named in my application and persons, hospitals, institutions, or practices with which I have been associated, professional societies, professional review organizations, state and federal agencies, the National Practitioner Data Bank, or other persons or entities, to obtain information regarding my professional competence, ability to deliver safe and efficient quality care, character, ethical qualifications, and professional liability claims history and/or insurance requested, for use in evaluating my application and continuing participation with the Steelworkers Worker Health Protection Program.

This authorization will remain in effect until it is revoked in writing by me and the revocation is received by the Steelworkers Worker Health Protection Program.

I hereby release, indemnify, and hold harmless the Steelworkers Worker Health Protection Program, its agents and employees and any and all individuals and organizations who provide information to the Steel workers Worker Health Protection Program in compliance with law and professional ethics, from any and all liability, claims, and damages including costs and attorney's fees arising out of activity authorized by the agreement.

This release section of the agreement survives termination of the agreement and revocation of authorization.

_____ _____

Applicant's Signature Date

_____

Type or Print Name Here

Confidential Physician Statement

A. Disciplinary Actions*

If the answer to any of the following questions is "Yes" please give full details on a separate sheet.

1. Have you ever been, or are you now in the process of being, denied, revoked, suspended, reduced, limited, placed on probation, monitored, or not renewed for any of the following? Or have you voluntarily relinquished, withdrawn, or failed to proceed with an application for any of the following in order to avoid an adverse action or to preclude an investigation or while under investigation relating to professional competence/conduct? ☐ Yes ☐ No

a. License to practice any profession in any jurisdiction ☐ Yes ☐ No

b. Other professional registration/license ☐ Yes ☐ No

c. Specialty or subspecialty board certification ☐ Yes ☐ No

d. Privileges/membership on any hospital/medical staff ☐ Yes ☐ No

e. Clinical privileges at any facility, including hospitals, ambulatory surgical centers, skilled nursing facilities, etc.

f. Professional society membership or fellowship ☐ Yes ☐ No

g. Participation/membership in an HMO, PPO, PHO, or other entity providing or arranging for health care services ☐ Yes ☐ No

h. Academic appointment ☐ Yes ☐ No

i. Authority to prescribe controlled substances (DEA) ☐ Yes ☐ No

2. Have you ever been subject to review and/or disciplinary action by an ethics? committee, licensing board, medical disciplinary board, professional association or education/training institution? ☐ Yes ☐ No

3. Have you been found by state professional disciplinary board to have committed unprofessional conduct as defined in applicable state provisions? ☐ Yes ☐ No

4. Have you ever been sanctioned by Medicare, Medicaid, US DHHS, a PSRO,

PRO/W, or similar agency? ☐ Yes ☐ No

5. Have you ever been convicted of or pleaded no contest to, or are you currently under investigation for any felony charges brought against you? ☐ Yes ☐ No

6. Do you have ownership in any medical laboratory or radiology facilities other? than that required for your own patients or the patients of your group? ☐ Yes ☐ No

*Claims/Lawsuits**

If "Yes" complete the attached reporting form for each action, or include a narrative report summarizing the claim.

1. Have there been, or are there currently pending, any malpractice claims, suits, settlements or arbitration proceedings involving your professional practice? ☐ Yes ☐ No

2. Have you ever been denied professional liability insurance or has your coverage been canceled or has a surcharge been imposed on your own claims experience?

☐ Yes ☐ No

*Quality of Care**

1. Are you unable to perform the essential functions involved in delivering safe? efficient quality care due to chemical dependency, substance abuse, or current mental or physical health conditions? ☐ Yes ☐ No

2. Are you unable to perform the essential functions involved in delivering safe? efficient quality care, with or without reasonable accommodation? (If yes, list the ☐ Yes ☐ No reasonable accommodations needed.)

***You are required to notify Queens College/USW of any disciplinary action, Claims/Lawsuits or quality of care issues should they occur after this document has been signed and submitted.**

Physician's/Physician Assistants' Signature Date

Type or Print Name Here

Attachment 3

MEDICAL SCREENING PROTOCOL
FOR THE FORMER WORKER MEDICAL SCREENING PROGRAM
U.S. DEPARTMENT OF ENERGY

General Principles:

1) The purpose of the medical evaluation component of the U.S. Department of Energy (DOE) Former Worker Medical Screening Program (FWP) is to provide interested former workers with targeted testing to screen for selected adverse health effects potentially related to their work in DOE operations. The program does not test for all potentially work-related conditions; for example, screening for work-related musculoskeletal conditions is not included in the medical evaluation.
2) The following table is intended to identify work-related health outcomes of relevance to DOE workers for which there are screening tests that are reasonably likely to be effective and beneficial to program participants. For example, a chest x-ray for screening for lung cancer for workers exposed to asbestos, beryllium, silica, chromium, or nickel is not included, because there is no evidence that it is effective for early detection in at-risk populations.
3) The selection of specific medical evaluations is based on the collection of a detailed occupational history for each worker.
4) This protocol is intended to ensure consistency of approach in the medical evaluation of participants.
5) This protocol is not intended to dictate the clinical practice of medicine.
6) This protocol is not intended to substitute for periodic health maintenance/disease screening examinations by a former worker's personal physician. However, as a secondary goal the examination may include assessments that contribute to general health.
7) Follow-up medical evaluation and treatment are not within the scope of the FWP.
8) This protocol was developed by consensus of the cooperative agreement awardees and the DOE officials associated with the FWP.
9) The medical evaluation protocol may be changed only by or with the approval of DOE.
10) The protocol will be reviewed and updated at least every two years by a committee established by DOE and the FWP.

Recommended Medical Screening Protocol for Selected Occupational Health Conditions
of DOE Workers For Which Screening and/or Early Detection
is Reasonably Likely to be Effective and Beneficial*

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
Asbestos	Lung	• Asbestosis • Other non-malignant respiratory disease • Lung cancer	• Chest radiograph with B-reading* • Spirometry • Physical examination	Up to every 3 years
Beryllium	Lung	• Sensitization • Chronic Beryllium Disease (CBD) • Lung cancer	• Chest radiograph with B-reading (if symptomatic)* • Physical examination • Beryllium Lymphocyte Proliferation Test (BeLPT), with repeat testing for other that normal results	• Up to every 3 years if asymptomatic • If new symptoms develop or worker is very concerned in interim, BeLPT can be performed
Plutonium, Lung Deposition of	Lung	• Pulmonary Fibrosis • Lung cancer	Chest radiograph*	Up to every 3 years
Silica	Lung	• Silicosis • Lung cancer	See Asbestos above*	Up to every 3 years
• Epoxy resins • Methylene dianiline • Other known bladder carcinogen	Bladder	Carcinoma	Urine cytology, plus additional biomarker supported by current research. Protocol should be tailored to specific exposure and approved by the DOE review process. [1]	Up to every 3 years
• Ionizing radiation • Chemicals (e.g., benzene)	Hematopoetic	Leukemia or non-malignant conditions	Complete blood count (CBC) with differential	Up to every 3 years

* DOE FWP recognizes that scientific evidence is rapidly accumulating on the use of low-dose chest CT scan for early lung cancer detection. In November 2010, the National Cancer Institute concluded a randomized clinical trial that demonstrated a 20% reduction in lung cancer mortality among high risk individuals who had an annual low dose CT scan. The DOE FWP endorses the use of low-dose chest CT scan for DOE workers who are at elevated lung cancer risk and, as of January 2011, is striving to broaden its current support of such screening at 7 DOE sites to additional workers in the DOE complex.

[1] When screening for bladder cancer is included, the participant should also receive recommendations for periodic screening. Initial screening will be supported by the FWP.

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
• Asbestos • Ionizing radiation	Gastrointestinal system	Carcinoma	Stool for occult blood[2]	Up to every 3 years[3]
Diesel Exhaust	Lung	• Chronic obstructive lung disease • Lung cancer	• Respiratory symptoms questionnaire • Spirometry*	Up to every 3 years
Welding	Lung	• Asthma • Chronic obstructive lung disease	• Respiratory symptoms questionnaire • Spirometry	Up to every 3 years for COPD
Chromium	Lung	• Asthma • Lung cancer	Respiratory symptoms questionnaire, plus spirometry, as indicated*	No
Formaldehyde	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
Metal Working Fluids	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
Nickel	Lung	• Asthma • Lung cancer	Respiratory symptoms questionnaire, plus spirometry, as indicated*	No
Respiratory irritants	Lung	Chronic obstructive lung disease	Respiratory symptoms questionnaire, plus spirometry, as indicated	Up to every 3 years
• Radioactive iodine • External ionizing radiation	Thyroid	thyroid disease	• Physical examination (i.e., palpation of the thyroid) • Thyroid-stimulating hormone (TSH)	Up to every 3 years
• Solvents • Lead • Mercury	Central Nervous System	Chronic neurologic disease	Clinical evaluation	No
Ionizing radiation	Female Breast	Cancer	Recommend mammography by personal physician for women 40 years of age or older[4]	Recommend mammography by personal physician for women 40 years of age or older[5]

[2] Recommend in letter that individuals discuss colonoscopy with PMD, per ACS guidelines
[3] Recommend in letter that individuals discuss colonoscopy with PMD, per ACS guidelines
[4] Communication to participant should recommend annual screening for women 40 years or age or older.
[5] Communication to participant should recommend annual screening for women 40 years or age or older.

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
Carbon tetrachloride and other chlorinated solvents	Liver	Hepatocellular injury and insufficiency	• Bilirubin • Transaminases	No
Hydrazine	Liver	Hepatocellular injury	Transaminases	No
• Cadmium • Chromium • Lead	Kidneys	Chronic renal insufficiency	Serum creatinine	No
• Nickel • Chromium • Formaldehyde	Skin	• Dermatitis • Skin cancer • Cancer of the nasal mucosa	Physical examination of the skin and nasal mucosa	No
Ionizing or ultraviolet radiation	Skin	Skin cancer	Physical examination of the skin[6]	Up to every 3 years[7]
Noise	Ears	Hearing Impairment	Audiometry	No
Laser, Class 3B and 4	Eyes, Skin	Cataracts, retinal burns	• Medical history of the eye and photosensitivity • Visual acuity (far and near) for both eyes • Amsler and Ishiharra[8]	No

[6] Communication to participant should recommend annual screening with PMD for anyone at high risk for skin cancer.
[7] Communication to participant should recommend annual screening with PMD for anyone at high risk for skin cancer.
[8] In accordance with ANSI Z136.1 Standard for the Safe Use of Lasers, which states that "Laser eye examinations are performed to identify those laser users which may have a predisposition for vision related injury and to meet the medical monitoring requirements of the standard."