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8 August 2010

CAPT Tim Radtke, CIH  
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CAPT Radtke:

I have enclosed a report of exposure assessments for Hoover Dam as part of the DOI Exposure Assessment and Medical Surveillance Inclusion project. In the report you will find two attachments and guidance for reading and interpreting assessment results. One attachment presents the processes, tasks, and agents that were evaluated during the 10-11 March 2010 on-site visit with details of the associated exposure profiles that were developed. The other provides a health risk-based prioritized summary list of process-task-agent groups for control and further information gathering.

An Access database containing complete data and supporting documentation is available for download at [www.BleicherCIH.com/DoleA4TR.html](http://www.BleicherCIH.com/DoleA4TR.html) (please note that the page address is case sensitive). This database file will be updated periodically as assessments and profiles are completed for additional facilities.

Please do not hesitate to contact me if you have any questions.

Sincerely,

David P. Bleicher, CIH

Enclosure: Hoover Dam Occupational Exposure Assessment

Hoover Dam  
Occupational Exposure Assessment and Medical Surveillance Inclusion  
For  
Department of Interior, Safety Council/Office of Health and Safety  
On-site: 10-11 March 2010

Exposure assessments have been conducted as a part of the Department of Interior's Exposure Assessment and Medical Surveillance Inclusion Determination initiative. The objective of this effort is to document work processes at DOI facilities, describe the individual tasks associated with those processes, identify hazardous agents that are used or generated during the task, and characterize employee exposure to those agents. The ultimate goal is to identify similarly exposed groups (SEGs) within and between bureaus in order to facilitate exposure management requirements including exposure control, validation of medical surveillance, and prioritized use of limited occupational health resources.

Methods.

Exposure assessments were conducted following the strategy set forth by the American Industrial Hygiene Association's Exposure Assessment Strategies Committee for assessing and managing occupational exposures<sup>1</sup>.

An on-site visit to Hoover Dam was conducted on 10-11 March 2010 by David P. Bleicher, CIH to characterize selected processes and collect information needed to develop task-agent exposure profiles. A number of methods were available and used to gather this information. Characterization of processes, tasks, conditions and controls, and agent identification was obtained through observation of work sites and facilities, documentation of procedures, material safety data sheets, and importantly, worker interview. Data useful for estimating exposure was obtained through screening and short term measurement, historical sampling data, mathematical modeling, and the scientific literature.

Two reports are provided for this facility (Attachments A and B). One presents the processes, tasks, and agents that were evaluated during the site visit along with details of the associated exposure profile. The other is a health risk-based prioritized summary list of process-task-agent groups for control and further information gathering.

Task-Agent Exposure Profile Detail Report.

Task-agent exposure profiles are based on observation and employee description of processes. Due to the nature of many DOI missions, processes and tasks can be highly variable—task duration, frequency, and operating conditions can differ from one iteration to another. Therefore, process and task characterizations were frequently, and necessarily, reported as "typical" with a range of conditions described. Judgments about worker exposure are based on the tasks as presented in this report. When actual processes or the conditions under which they are carried out differ from those recorded, the exposure profile and classification should not be generalized without appropriate consideration of variables.

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<sup>1</sup> Bullock, Wm.H. and J.S.Ignacio, Eds. 2006. A Strategy for Assessing and Managing Occupational Exposures, 3<sup>rd</sup>. AIHA Press, Fairfax.

### *Reading the Report.*

The Task-Agent Exposure Profile Detail Report is arranged in hierarchical fashion by Division or Project, Process, Task, and Agent. Process entries include a brief description of the process and when appropriate, unique operating conditions. Task entries include a brief characterization of the task, a description of any controls in place, the duration and frequency of occurrence, and appropriate recommendations. It should be noted that many task characterizations and agent exposure profiles will immediately suggest rather obvious recommendations. Some of these have been included in the report. However, in many cases it would not be appropriate to make definitive control recommendations without more careful consideration of control strategies and factors that would affect their efficacy (e.g. design, economic, and cultural factors) which is beyond the scope of the exposure assessment project.

*Exposure Profile.* Information used to develop the exposure profile is found for each Agent under a Task. It is important to understand that the exposure profile accounts for engineered and administrative controls and reflects potential worker exposure in the absence of personal protective equipment such as respirators.

- Exposure Category: Exposures have been categorized as Acceptable, Unacceptable, or Uncertain.
- OEL: The Occupational Exposure Limit or OEL is the threshold value used as a standard for comparison with the exposure estimate. OELs may describe full shift or short-term acceptable or unacceptable exposure limits.
- Exposure Rating & Exposure Estimate: When possible the Exposure Rating is based on quantitative data which yields an Exposure Estimate. In practice, very little quantitative information is available to support a judgment. In the absence of strong quantitative data, it is often practical and reasonable to categorize an exposure as acceptable, unacceptable, or uncertain based on qualitative or semi-quantitative information. However, in these cases it is difficult to assign intermediate exposure ratings as a fraction of the OEL, therefore an exposure rating of 4 is assigned to clearly unacceptable exposures and a rating of 1 for those that are clearly acceptable.
- Health Effects Rating: The Health Effects Rating reflects both the severity and permanence of the health impacts of an unacceptable exposure.
- Uncertainty Rating: The Uncertainty Rating provides an indicator of the level of certainty associated with the exposure profile. For example; exposure estimates based on definitive monitoring studies would be highly certain while profiles based on screening measurement, mathematical modeling, data from similar activities, or qualitative judgment may add degrees of uncertainty. Other factors that may affect the industrial hygienist's assignment of an uncertainty rating are inadequate understanding of health impacts by scientific community and excessive generalization of the task activity or conditions during the characterization process.
- Basis & Discussion: The Basis for the estimated exposure, its assignment to an exposure category, and the factors affecting certainty is given. A brief Discussion of available information and factors leading to judgments about the exposure profile is also provided.
- Risk/Control Priority: A Risk/Control Priority is calculated as the product of the Health Effects Rating and the Exposure Rating. Ratings range from 0 for the lowest risk exposures to a high of 16.

- FIG Priority: When uncertainty exists in the exposure profile, further information gathering may be required to resolve it. FIG Priority is calculated as the product of the Risk/Control Priority and the Uncertainty Rating. Both the Risk/Control Priority and the FIG Priority values may be used to more efficiently direct resources to control exposures and resolve exposure questions. FIG priority ratings range from a low of 0 to a high of 32.

*Medical Surveillance.* The exposure profile provides validation of, or indicates justification for, medical surveillance programs. In the report, medical surveillance is Justifiable when the exposure category is unacceptable or uncertain. Note that justifiable means simply that an unacceptable (or uncertain) exposure is identified. It does not suggest that medical surveillance is required, needed or even useful. On the other hand, some exposures are designated as Triggered or Critical Exposures. For unacceptable or uncertain exposure to some agents, medical surveillance may be triggered or required by regulation. A critical exposure refers to unacceptable or uncertain exposure to an agent which may pose very severe and irreversible health effects if not controlled. Examples include potent human carcinogens.

David P. Bleicher, CIH  
8 August 2010

Attachment A: Task-Agent Exposure Profile Detail Report  
Attachment B: Health Risk and Further Information Gathering Priorities Report

# Task-Agent Exposure Profile Detail Report

## Hoover Dam

### Environmental Compliance Group

**Process:** Wastewater Water Treatment Plant

The plant is a denitrification plant (biological nutrient removal) with aerobic and anaerobic digestion, and settling processes. Plant services operational and visitor facilities. Influent is low in solids.

**Operating Conditions:**

Plant is contained in the Arizona adit with access via penstock tunnel. Passive dilution ventilation is enhanced with an exhaust system on ceiling. Temperatures reportedly reach up to 100F within the tunnel. Operator's booth is air conditioned.

**Task:** Back Up Chlorination

One gallon jugs of 10% sodium hypochlorite solution are used as a backup to the MIOX system in case of failure and is also used routinely to augment or boost MIOX system. Operator fills proportioner or metering tank. Jugs are uncapped and poured into tank, 1 gallon at a time.

**Frequency:** Daily

**Duration:** <1/2 hour

**Controls:**

**Recommendation:**

Protect face and eyes from splash by using splash resistant goggles or face shield.

**AGENT** Sodium Hypochlorite

**OEL:** 2 mg/m3

**Exposure Estimate:** mg/m3

**Health Effects Rating:** 2 Severe, reversible health effects of concern

**Exposure Rating:** 1 (<10% OEL; 95th %tile <0.1 OEL)

**Exposure Category:** Acceptable

**Uncertainty:** 0 Certain

**Risk/Control Priority:** 2

**Basis:** Qualitative Judgement

**FIG Priority:** 0

**Discussion:** Pouring 10% solution from one gallon jugs may result in splash or spill, with tissue damage or strong irritant response on contact. Inhalation risk is low during this operation. OEL considered is AIHA WEEL of 2 mg/m3. Respiratory hazard as chlorine (PEL=0.5 ppm)

**Medical Surveillance** Justifiable no

Triggered or Critical Exposure no

Reference:

**Task:** Dechlorination

Sodium sulfite cakes are loaded into system. Each day the operator breaks up previous day's cake and loads fresh product consisting of seven D-clor tablets.

**Frequency:** Daily

**Duration:** <1/2 hour

**Controls:**

**Recommendation:**

**AGENT** Sodium sulfite

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

**Discussion:** Solid sodium sulfite can produce strong irritant effects to skin, eyes, and lungs with exposure to dust. Product is in solid cake form with little risk of dust release. Dry product handled with nitrile-gloved hand. Low exposure risk based on product formulation, quantity of material used, and process technique.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure no

Reference:

**Task:** General Plant Operations

Frequency: Weekly

General Operations occur in 8 hour shifts. High heat conditions during product receipt on Arizona ramp during summer season are reported .

Duration: 4 - 8 hours

**Controls:**

Air conditioned operator's booth.

**Recommendation:**

Consider application of ACGIH WBGT threshold values for management of heat stress and prevention of heat strain.

**AGENT** Heat

OEL:

Exposure Estimate:

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Engineering Controls in Place

FIG Priority: 4

**Discussion:** When ambient outdoor temps reach 120F, hot humid conditions reported in cave. Duration and frequency are variable. Metabolic heat generation not characterized. Work-rest cycle and air conditioning in operator's booth will reduce heat strain.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure no

Reference:

**Task:** Macerator, Pump, and Blower Maintenance

Frequency: Monthly

Monthly lubrication, greasing and changing of oil is conducted without opening pump to pack bearings. There is no raw sewage exposure. In addition, quarterly preventive or annual maintenance is conducted (such as on blower filters).

Duration: 1 - 4 hours

**Controls:****Recommendation:**

**AGENT** Lubricants; oil, grease

OEL:

Exposure Estimate:

Health Effects Rating: 0 Reversible health effects of little concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 0

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Primary route of exposure is dermal exposure. Barrier protections are used. Limited contact with products used are not expected to result in health effects of concern.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Task:** pH Adjustment

Frequency: Bi-Monthly

Operator adds soda ash to a bin for automatic metering into anoxic zone basin 1. Product is a fine powder that is poured or scooped slowly into the bin to avoid dust generation.

Duration: <1/2 hour

Controls:

Recommendation:

Wear APR with N95/N100 filter and eye protection when conducting this task.

**AGENT** Sodium Carbonate

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: Mixed with water, such as in the eye and lung, material is corrosive to tissue. Finely divided powdered product will be released into the air when transferred. Operator technique will be a major factor is dust generation. Exposure duration is limited and the operation occurs periodically. Respirator and eye protection use not reported during operation.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Process:** Water Treatment Plant

Located in the Arizona Valve House, the water treatment plan consists of mixed media filters and adsorption clarifiers.

Operating Conditions:

Arizona valve house retains comfortable temperatures year round.

**Task:** Mixing Coagulant Solution

Frequency: Bi-Monthly

A ferric chloride solution is mixed from 5 gallon containers of concentrated 28-43% solution. Open beakers are used for measuring. The beaker is filled and then the concentrate is poured manually into tank to make 10 gallons of stock solution. Mixing is conducted on waist high stainless steel bench.

Duration: 1/2 - 1 hour

Controls:

Recommendation:

**AGENT** Ferric chloride

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Skin and mucus membrane exposure to concentrate solution is the primary risk. Glove and face shield barriers are used.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** pH Adjustment

Frequency: Bi-Annually

Concentrated sulfuric acid (93%) is transferred to the adsoption clarifier from a bulk 55 gal drum to a 35 gal double-walled tank. A peristaltic pump is used to make the transfer. When the transfer is complete the pump tubing moved to a 5 gallon bucket for rinsing.

Duration: 1 - 4 hours

Controls:

Recommendation:

**AGENT** Sulfuric acid

OEL: 0.2 mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 4

Basis: Mathematical Modeling

FIG Priority: 0

Discussion: Task is short duration and mostly automated allowing worker to remain at a distance from the process. Airborne acid release will occur as the tank is filled. Starting tank head space concentration estimate is based on the saturation model giving concentrations up to 5.28 mg/m3 or a maximum of approximately 0.7 mg in the 35 gallon tank that could be released as the tank fills over a period of up to 4 hours. Skin and mucus membrane exposure is the primary risk. Face and full body barriers are used.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**General Maintenance Group**

**Process:** Cavitation Repair Using Epoxy Filler

Use Belzone 2 part epoxy filler to repair baffle plate (part of the head cover). Surface is prepared by sand blasting. After epoxy has set the surface is sanded with about 100 grit. After sanding, work is cleaned using compressed air.

Operating Conditions:

Parts are removed and work is conducted at warehouse after abrasive blasting. Open air on back of flat bed truck.

**Task:** Epoxy Filler Application

Frequency: Single Event

Mixed golfball sized batches in gloved hand; applied using hand.

Duration: 1/2 - 1 hour

Controls:

Recommendation:

**AGENT** Epoxy Resin

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Task is short duration. Adequate barrier protection limits skin contact, the primary route of exposure for this task and product.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Process:** Chemical stripping of paints.

Use aerosol gasket remover for stripping epoxy paints from approximately 1 sq. ft. of generator extension housing surface.

Operating Conditions:

Work is conducted in the main power house.

**Task:** Stripping Paint

Frequency: Single Event

"Locktite Chisel Paint Stripper" is applied as a foaming aerosol application that is followed by hand wiping. This task has not been adequately characterized, but is reportedly conducted infrequent and of short duration.

Duration:

Controls:

None described.

Recommendation:

Consider discontinuing use of methylene chloride containing stripper products.

**AGENT** Methylene chloride

OEL: 125 ppm

Exposure Estimate: ppm

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 4 (>10% OEL; 95th %tile > OEL)

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 16

Basis: Qualitative Judgement

FIG Priority: 32

Discussion: Volatile material with significant inhalation and skin absorption exposure potential with critical health effects. OEL is STEL. Task was reported as infrequent or single event. Personal protective equipment, environmental controls were not described.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1910.1052

**Process:** Clean Generator Coil

Generator coils are cleaned using cotton rags and detergent amended water that is dispensed using a manual spray bottle. Removal of intact existing coating material is avoided. This is a periodic repair event that may not be related to overhauls.

**Operating Conditions:**

Work may be conducted within the break housing, but is usually removed to rotor pit.

**Task:** Clean Generator Coil

**Frequency:** Single Event

**Duration:** 1/2 - 1 hour

Generator coils are cleaned using cotton rags and detergent amended water that is dispensed using a manual spray bottle. Removal of intact existing coating material is avoided. This is a periodic repair event that may not be related to overhauls. Surfaces to be cleaned may contain asbestos from the break housing.

**Controls:**

**Recommendation:**

<b>AGENT</b> Asbestos	OEL:	0.1 f/cc
Exposure Estimate:	f/cc	Health Effects Rating: 4 Life threatening or disabling injury or illness
Exposure Rating:	1 (<10% OEL; 95th %tile <0.1 OEL)	Exposure Category: Uncertain
Uncertainty:	1 Uncertain	Risk/Control Priority: 4
Basis:	Qualitative Judgement	FIG Priority: 4
Discussion:	Asbestos from brakes may present on coil and braking housing surfaces in undetermined quantities.	
<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1910.1001

<b>AGENT</b> Lubricants; oil, grease	OEL:	
Exposure Estimate:	0	Health Effects Rating: 0 Reversible health effects of little concern
Exposure Rating:	1 (<10% OEL; 95th %tile <0.1 OEL)	Exposure Category: Acceptable
Uncertainty:	1 Uncertain	Risk/Control Priority: 0
Basis:	Qualitative Judgement	FIG Priority: 0
Discussion:	Oil films on surfaces to be cleaned generally present a low level dermal hazard. Oil composition was not determined. Barrier protections are used by workers during this process.	
<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Particulates, NOS

OEL: 5 mg/m3

Exposure Estimate: 0 mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis:

FIG Priority: 1

**Discussion:** Reported contact with carbon dust minimized by use of wet cleaning methods. Method also requires frequent change of rags which may also limit aerosolization of dusts. Disposition of used rags was not reported. Bagging used rags prior to them drying will minimize release of dusts.

**Medical Surveillance** Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Process:** Coating Turbine Oil Tank

The oil tank on the turbine is cleaned with alcohol or detergent by hand wiping with white cotton rags. An epoxy coating is then applied by brush or roller.

**Operating Conditions:**

Tank is 300-400 gallons and located in the generator gallery. Work is conducted with the top of the tank removed.

**Task:** Apply Epoxy, Brush or Roller

**Frequency:** Annually

Apply epoxy to tank surfaces using brush or roller. Note: Glyptol 74004 is the product reported used in this task. Per the manufacturer, It requires a catalyst, however, this product was reported as a single part product.

**Duration:** 1 - 4 hours

**Controls:**

**Recommendation:**

**AGENT** Epoxy Resin

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

**Discussion:** Glyptol epoxy enamel 74004 contains polyamine resin. Uncured epoxy resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment. Other components of this product were not evaluated.

**Medical Surveillance** Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** Clean Surface Prior to Coating

**Frequency:** Annually

Using ethanol or detergent and water, tank surface is cleaned by wiping with rags. This task is conducted only during turbine overhaul.

**Duration:** 4 - 8 hours

**Controls:**

Enclosed space with no mechanical ventilation reported.

**Recommendation:**

**AGENT Ethanol**

OEL: 1000 ppm

Exposure Estimate: 1000 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Qualitative Judgement

FIG Priority: 8

Discussion: Denatured Ethanol is used in large quantities (1 gal or approximately 3000 mg) in an enclosed space with a volume of 300 to 400 gallons (1.137-1.516 m<sup>3</sup>) without mechanical ventilation. OEL is ACGIH STEL.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**Process: Drill Concrete Core**

Using a three inch core drill, cores are cut in concrete for running pipe or other utilities, or for anchoring. Holes may be drilled in order to lag bolt core drill to the surface or a suction cup may be used to secure the core drill.

**Operating Conditions:**

Operation may occur in enclosed spaces such as shafts or in open spaces.

**Task: Core Drilling**

Frequency: Monthly

Use three inch core drill to cut concrete. Water is used for cooling the hollow diamond tipped bits. Drill is capable of boring approximately 1 foot every 10 minutes.

Duration: 1/2 - 1 hour

**Controls:****Recommendation:****AGENT Noise**

OEL: 85 dBA

Exposure Estimate: dBA

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 6

Basis: Existing Quantitative Data

FIG Priority: 6

Discussion: Core drills were not operated during this assessment and sound level and noise dosimetry data was not available for this piece of equipment and this task. However, equipment of this type commonly produces continuous sound levels above 90 dBA.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1010.95

**AGENT** Silica, crystalline quartz

OEL: 0.025 mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 3

Discussion: OEL is ACGIH TLV for respirable crystalline silica. Water cooling of drill bit during cutting is expect to effectively control dust generated during the task. Dry drilling of anchor holes for core saw may be expected to liberate silica containing dust, which, based on the frequency and short duration would not be expected to exceed the exposure threshold.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Process:** Penstock Coating

Penstock inside surfaces are recoated. This process may require the application of a rust activated converter/sealer applied by roller, brush or spray bottle. Then, two part epoxy is applied using brush and roller or airless HVLP sprayer. Touch up is conducted using roller or brush.

**Operating Conditions:**

Work is conducted inside penstock and scroll cases of 13 ft in diameter. Quagga mussels may cover surface. Scroll case may require treatment of 100 sq.ft.

**Task:** Apply Epoxy Coating Using HVLP Sprayer

Frequency: Annually

Apply DEVOE Devtar 5A in penstocks using HVLP sprayer. Application may require 1-4 hrs /day depending on size of the project. Task may occur annually for period of ten days. Up to 10 gallons may be applied per day.

Duration: 1 - 4 hours

**Controls:**

Negative air machines used. Work is conducted within enclosures.

**Recommendation:**

**AGENT** Epoxy Resin

OEL: mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: Devoe 5A contains 10-15% epoxy resin. "Industrial hygiene air monitoring for ECH has been done in a number of workplaces, involving a variety of epoxy resin end-uses. Most of the monitoring has shown no detectable levels of ECH in the air. Uncured epoxy resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment." (OSHA Technical Manual). Skin barrier protection is used when conducting this task. Fullface APR with N100 filters will reduce risk of inhalation of aerosolized resin mist generated in the spray process.

Medical Surveillance Justifiable yes  
Triggered or Critical Exposure no  
Reference:

**AGENT Ethylbenzene**

OEL: 100 ppm

Exposure Estimate: 166 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Qualitative Judgement

FIG Priority: 8

Discussion: Agent makes up 1-7.5% of product. Application method and quantity of product applied over 1 hour likely to exceed OEL even with use of mechanical ventilation. The fullface air purifying respirators used have an assigned protection factor that should, when used properly, provide protection up to 50 times the OEL. Agent concentrations will be dependant on efficacy of mechanical ventilation, size of the enclosure, and quantity of product sprayed.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT Hydrocarbon Resin**

OEL: mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: Devoe 5A contains 20-25% aeromatic petroleum resin. Uncured resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment. Skin barrier protection is used when conducting this task. Fullface APR with N100 filters will reduce risk of inhalation of aerosolized resin generated in the spray process.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** n-Butanol

OEL: 20 ppm

Exposure Estimate: 297 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 5-10% agent. OEL is TLV, which defines a low acceptable concentration. Typical reported application rates will release up to 4 L of agent into the enclosed penstock space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 900 mg/m<sup>3</sup> (approximately 297 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Xylenes

OEL: 100 ppm

Exposure Estimate: 440 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Agent makes up 10-20% of product. Application method and quantity of product applied over 1-4 hours likely to exceed OEL even with use of mechanical ventilation. The fullface air purifying respirators used have an assigned protection factor that should, when used properly, provide protection up to 50 times the OEL. Agent concentrations will be dependant on efficacy of mechanical ventilation, size of the enclosure, and quantity of product sprayed.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Apply Epoxy Using Airless Sprayer

Frequency: Annually

Apply Devco 235 2 part Bar Rust product is applied in the scroll case using airless sprayer. This task may occur annually and require 4-8 hours over a 2 day period with approximately 30 gallons of product applied.

Duration: 4 - 8 hours

Controls:

Recommendation:

**AGENT** Epoxy Resin

OEL:

Exposure Estimate:

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

**Discussion:** "Industrial hygiene air monitoring for ECH has been done in a number of workplaces, involving a variety of epoxy resin end-uses. Most of the monitoring has shown no detectable levels of ECH in the air. Uncured epoxy resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment." (OSHA Technical Manual). Skin barrier protection is used when conducting this task. Large volumes of product are applied in the limited volume of the enclosed scroll case space will likely produce high levels of product mist increasing risk of contact exposure and inhalation aerosolized product agents including uncured epoxy. Barrier protections are worn, including full face respirator.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Ethylbenzene

OEL: 100 ppm

Exposure Estimate: 17 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 4

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains less than 1% agent. OEL is TLV/PEL TWA. Typical reported application rates will release up to 600 ml of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 72 mg/m<sup>3</sup> (approximately 17 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Methyl n-amyl ketone

OEL: 50 ppm

Exposure Estimate: 72 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 1-5% agent. OEL is TLV. Typical reported application rates will release up to 3 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 338 mg/m<sup>3</sup> (approximately 72 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** n-Butanol

OEL: 20 ppm

Exposure Estimate: 223 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 5-10% agent. OEL is TLV, which defines a low acceptable concentration. Typical reported application rates will release up to 6 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 675 mg/m<sup>3</sup> (approximately 223 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Petroleum Distillate

OEL: 350 ppm

Exposure Estimate: 67 ppm

Health Effects Rating: 0 Reversible health effects of little concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 0

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 1-5% agent. OEL is REL. Typical reported application rates will release up to 3 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 271 mg/m<sup>3</sup> (67 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Polyisocyanate compound

OEL: ppm

Exposure Estimate: ppm

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

**Discussion:** Product contain from 1-5 % agent (proprietary compound--alkyl phenol blocked polyisocyanate). Free isocyanate functional groups can initiate strong sensitization reactions. Prepolymerized products contain fewer free functional groups and therefore present a decreased risk. Monomeric isocyanate compounds have very low thresholds in the range of 0.005 ppm. Low volatility of these compounds result in low inhalation exposure. Barrier protections provide control of dermal exposure.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Trimethyl benzene

OEL: 25 ppm

Exposure Estimate: 75 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 1-5% agent. OEL is TLV which defines a low acceptable exposure threshold. Typical reported application rates will release up to 3 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 367 mg/m<sup>3</sup> (75 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Xylenes

OEL: 100 ppm

Exposure Estimate: 83 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 3 (50-100% OEL; 95th %tile 0.5-1.0 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 6

Basis: Qualitative Judgement

FIG Priority: 6

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL. Typical reported application rates will release up to 3 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task.

Box model utilizing reported frequency and durations along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 358 mg/m<sup>3</sup> (83 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Apply Rust Converter and Sealer, Brush Application

Frequency: Annually

Spot application of rust converter/sealer are made using a brush when rust is visibly present. Work is conducted during turbine overhaul. Product is Devoe Bar-Rust 235. Typically, applications of 1 qt of product are made.

Duration: 4 - 8 hours

**Controls:**

Natural convective air circulation.

**Recommendation:**

**AGENT** Epoxy Resin

OEL: mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

**Discussion:** "Industrial hygiene air monitoring for ECH has been done in a number of workplaces, involving a variety of epoxy resin end-uses. Most of the monitoring has shown no detectable levels of ECH in the air. Uncured epoxy resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment." (OSHA Technical Manual). Skin barrier protection is used when conducting this task.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Ethylbenzene

OEL: 100 ppm

Exposure Estimate: 1 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains less than 1% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 10 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 0.6 mg/m3 (< 1 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Kerosene

OEL: 200 ppm

Exposure Estimate: 1 ppm

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 50 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 2.8 mg/m<sup>3</sup> (< 1 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Methyl n-amyl ketone

OEL: 50 ppm

Exposure Estimate: 1 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 50 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 2.8 mg/m<sup>3</sup> (< 1 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** n-Butanol

OEL: 50 ppm

Exposure Estimate: 2 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 5-10% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 100 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 5.6 mg/m<sup>3</sup> (< 2 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Petroleum Distillate

OEL: 1800 ppm

Exposure Estimate: 3 ppm

Health Effects Rating: 0 Reversible health effects of little concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 0

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 10-20% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 200 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 9 mg/m<sup>3</sup> (2.2 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Polyisocyanate Compound

OEL: ppm

Exposure Estimate: ppm

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

**Discussion:** Product contain from 1-5 % agent (proprietary compound--alkyl phenol blocked polyisocyanate). Free isocyanate functional groups can initiate strong sensitization reactions. Prepolymerized products contain fewer free functional groups and therefore present a decreased risk. Monomeric isocyanate compounds have very low thresholds in the range of 0.005 ppm. Low volatility of these compounds result in low inhalation exposure. Barrier protections provide control of dermal exposure.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** trimethyl benzene

OEL: 25 ppm

Exposure Estimate: 1 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 50 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 1.5 mg/m<sup>3</sup> (<1 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Xylenes

OEL: 150 ppm

Exposure Estimate: 1 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 0

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. STEL and TWA not expected to be reached based on quantity of product used (1 qt) over period of more that 4 hours.

Typical reported application rates will release up to 50 ml of agent into the enclosed penstock space. Concentrations of agent developed over the 4-8 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (4 hrs) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 3 mg/m3 (< 1 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Apply Rust Converter Using Brush and Roller

Frequency: Annually

Apply Devoe BarRust 235 2 part rust converter/sealer in scroll case using brush and roller, achieving 8-10 mil coating. Task is conducted between 30 and 40 days per year during a 6 month overhaul period. Typically approximately 12 L of product are applied in a day.

Duration: 1 - 4 hours

Controls:

Recommendation:

**AGENT** Epoxy Resin

OEL: mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

**Discussion:** "Industrial hygiene air monitoring for ECH has been done in a number of workplaces, involving a variety of epoxy resin end-uses. Most of the monitoring has shown no detectable levels of ECH in the air. Uncured epoxy resins can present a significant dermal exposure hazard. In many workplaces, manual processing results in potential skin exposure. This can result in skin irritation, rashes and, subsequently, dermatitis if contact is prolonged. Sensitization to the resins can also develop and may require a change of work assignment." (OSHA Technical Manual). Skin barrier protection is used when conducting this task.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT Ethylbenzene**

OEL: 100 ppm

Exposure Estimate: 83 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 3 (50-100% OEL; 95th %tile 0.5-1.0 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 6

Basis: Mathematical Modeling

FIG Priority: 6

Discussion: Product contains less than 1% agent. OEL is TLV/PEL TWA. STEL and TWA may be approached based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 120 ml of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 358 mg/m<sup>3</sup> (83 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT Kerosene**

OEL: 200 ppm

Exposure Estimate: 39 ppm

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 2

Basis: Mathematical Modeling

FIG Priority: 2

Discussion: Product contains 1-5% agent. OEL is TLV/PEL TWA. TWA is not expected to be exceeded based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 600 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 270 mg/m<sup>3</sup> (39 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Methyl amyl ketone

OEL: 50 ppm

Exposure Estimate: 58 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. TWA may be exceeded based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 600 ml of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 270 mg/m<sup>3</sup> (58 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** n-Butanol

OEL: 20 ppm

Exposure Estimate: 178 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 5-10% agent. OEL is TLV/PEL TWA. TWA may be exceeded by a large margin based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 1.2 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 540 mg/m<sup>3</sup> (178 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Petroleum Distillate

OEL: 500 ppm

Exposure Estimate: 268 ppm

Health Effects Rating: 0 Reversible health effects of little concern

Exposure Rating: 3 (50-100% OEL; 95th %tile 0.5-1.0 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 0

Basis: Mathematical Modeling

FIG Priority: 0

Discussion: Product contains 10-20% agent. OEL is TLV/PEL TWA. TWA is not expected to be exceeded based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 1.2 L of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 540 mg/m<sup>3</sup> (178 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Polyisocyanate compound

OEL: ppm

Exposure Estimate: ppm

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Product contain from 1-5 % agent (proprietary compound--alkyl phenol blocked polyisocyanate). Free isocyanate functional groups can initiate strong sensitization reactions. Prepolymerized products contain fewer free functional groups and therefore present a decreased risk. Monomeric isocyanate compounds have very low thresholds in the range of 0.005 ppm. Low volatility of these compounds result in low inhalation exposure. Barrier protections provide control of dermal exposure.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Trimethyl benzene

OEL: 25 ppm

Exposure Estimate: 60 ppm

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Mathematical Modeling

FIG Priority: 8

**Discussion:** Product contains 1-5% agent. OEL is TLV/PEL TWA. TWA is expected to be exceeded based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 600 ml of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 293 mg/m<sup>3</sup> (60 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Xylenes

OEL: 150

Exposure Estimate: 66

Health Effects Rating: 2 Severe, reversible health effects of concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Mathematical Modeling

FIG Priority: 4

**Discussion:** Product contains 1-5% agent. OEL is STEL. TWA and STEL are not expected to be exceeded based on quantity of product used (3 gal) over period of 1 hour.

Typical reported application rates will release up to 600 ml of agent into the enclosed scroll case space. Concentrations of agent developed over the 1-4 hour task duration will vary depending on ventilation rates. Mechanical ventilation was not recorded for this task. Box model utilizing reported frequency and durations (1 hr) along with highly uncertain assumptions of volume and air flow within the space yield steady state concentration estimate of 287 mg/m<sup>3</sup> (66 ppm).

Note that combined effects of agents with similar health effects and target organs is not accounted for in this profile.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**Task:** Cleanup After Blasting

Frequency: Annually

Brooms, shovels, and shop vacs are used to cleanup blasting debris within the enclosure in the scroll case. Debris is collected in 55 gallon drums, then transported to the hazmat area for storage. Clean up may require 1-4 hours per day for up to 5 days per project.

Duration: 1 - 4 hours

Controls:

Recommendation:

Use N100 rather than OV cartridges during this task.

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate:  dBAHealth Effects Rating:  Irreversible health effects of concernExposure Rating:  (10-50% OEL; 95th %tile 0.1-0.5 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Sound levels from shop vacuums and ventilation system were not evaluated. Exposure will vary with time spent using vacs and proximity to ventilation system. Task duration varies from 1-4 hours.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

**AGENT** Particulates, NOSOEL: Exposure Estimate: Health Effects Rating:  Reversible health effects of concernExposure Rating:  (10-50% OEL; 95th %tile 0.1-0.5 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Dust will be aerosolized by dry sweeping methods and use of coarsely filtered shp vacs, but not expected to reach high exposure threshold for total or respirable particulates.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure no

Reference:

**Task:** Sandblast Scroll Case

Frequency: Annually

Scroll Case is enclosed with 6 mil plastic sheeting supported by pvc frame (reportedly compliant with asbestos abatement methods). Green diamond abrasive is used to blast surfaces in preparation for epoxy coating. Grit is designed to be lead encapsulating. Blasting takes over a 5 day period once a year.

Duration: 4 - 8 hours

**Controls:**

A "negative air" exhaust system is set up in the enclosure with the intake at least four feet from work. Filtered air is discharged into the enclosure. System capacity was not determined.

**Recommendation:****AGENT** Lead

OEL: 50 ug/m3

Exposure Estimate:  ug/m3Health Effects Rating:  Irreversible health effects of concernExposure Rating:  (<10% OEL; 95th %tile <0.1 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Lead may be present in older surface coatings. Newer epoxy coatings do not contain lead.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1025

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: 0 dBA Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable

Uncertainty: 1 Uncertain Risk/Control Priority: 12

Basis: Qualitative Judgement FIG Priority: 12

Discussion: Sound level measurement or dosimetry data is not available for this task, however, abrasive blasting frequently exceeds the allowable dose. Long duration exposure (4-8 hours) is expected to produce unacceptable exposure in the absence of hearing protection devices.

Medical Surveillance Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

**AGENT** Particulates, NOS

OEL: 5 mg/m3

Exposure Estimate: 0 mg/m3 Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable

Uncertainty: 1 Uncertain Risk/Control Priority: 4

Basis: Qualitative Judgement FIG Priority: 4

Discussion: Thirty to 50 pounds of Green Diamond abrasive is reportedly used in a typical day. Product is approximately 50% SiO<sub>2</sub>, free of crystalline silica.

Medical Surveillance Justifiable yes

Triggered or Critical Exposure no

Reference:

**Mechanical Group****Process:** Cavitation Repair

Repair pitting on turbine blades. Pitting can extend up to 1 " into metal. Pits are ground to open them, dyed to reveal cracks, then filled with metal (shielded metal arc welding w. Arcaloy 309 mol), ground and repeated. Process extends through 10 hour shift. Process can require as much as one month to 50 days per turbine. There are 18 "buckets" in a wheel. A bucket is the space created two turbine blades.

**Operating Conditions:**

All work is conducted in the power house. Local exhaust ventilation is established to direct contaminants into a hood and duct in the center of the turbine wheel. Captured air is HEPA filtered and discharged into powerhouse space.

**Task:** Inspection Using Penetrating Dye

Frequency: Daily

Duration: 1/2 - 1 hour

Two part application of dye and developer is used to determine whether grinding and removal of cavitated material is sufficient. Materials are applied using aerosol products. The application may be repeated several times. Six 12 oz cans each of Magnaflux Spotcheck SKL-SP Penetrant (containing white mineral oil 8042-47-5, isobutane, hydrotreated naphthenic distillate 64742-53-6) and SKD-2 Developer (containing acetone, isopropyl alcohol, kaolin 1332-58-7, and talc) are typically used in a 50 day turbine repair project.

**Controls:**

Local exhaust into the "bucket," about 4-5 feet from work; filtered; recirculated. Local exhaust with hoods placed 4-5 feet from the source are typically not capable of efficiently capturing contaminants as they are generated. Efficiency may be improved in this case with the hood positioned within the bucket. The bucket may serve to extend the hood and encloses the work.

**Recommendation:**

<b>AGENT</b> Acetone	OEL:	750 ppm
Exposure Estimate: 0 ppm	Health Effects Rating:	2 Severe, reversible health effects of concern
Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)	Exposure Category:	Acceptable
Uncertainty: 0 Certain	Risk/Control Priority:	2
Basis: Qualitative Judgement	FIG Priority:	0
Discussion: Short duration use of small quantity aerosol application not expected to exceed TLV of 500 ppm or STEL of 750 ppm.		
<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

<b>AGENT</b> Isobutane	OEL:	800 ppm
Exposure Estimate: 0 ppm	Health Effects Rating:	2 Severe, reversible health effects of concern
Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)	Exposure Category:	Acceptable
Uncertainty: 0 Certain	Risk/Control Priority:	2
Basis: Qualitative Judgement	FIG Priority:	0
Discussion: No OSHA PEL, generally considered safe, including food uses; NIOSH describes possible sudden death due to ventricular fibrillation as a result of acute exposure. Exposure <TWA OEL based of quatity and duration of product use.		
<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Naphthenic Distillate

OEL: 10 mg/m3

Exposure Estimate: 0 mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Health effects of low concern; Exposure to small quantities aerosol for short durations; low volatility; OEL is 15 minute STEL.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** oil mist

OEL: 10 mg/m3

Exposure Estimate: mg/m3

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: White mineral oil health effects of low concern; Exposure to small quantities aerosol for short durations; low volatility; OEL is 15 minute STEL

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Welding, Metal Filling and Grinding Stainless Steel

Frequency: Daily

Cavitation-generated pits and damage are ground and new metal is laid down using shielded metal arc rod (ESAB Welding ArcAloy 309MOL) in one or more passes. Work is conducted with employee's "head stuck in the bucket." Work may continue throughout a 10 hour shift. Welding rod composition includes 23% chromium, 2.5 % molybdenum, 13% nickel, and 1.7% manganese. Surface is ground to just above flush; then an angle grinder with 220 grit paper progressing to 400 grit, is used for final finish. Typically, 4 people work on one wheel at a time and shift from vein to vein ("bucket to bucket") to manage interpass or between pass, temperatures.

Duration: extended shift

**Controls:**

Local exhaust into the "bucket," about 4-5 feet from work; filtered; recirculated. Local exhaust with hoods placed 4-5 feet from the source are typically not capable of efficiently capturing contaminants as they are generated. Efficiency may be improved in this case with the hood positioned within the bucket. The bucket may serve to extend the hood and encloses the work.

**Recommendation:**

**AGENT** Chromium VI

OEL: 5 ug/m3

Exposure Estimate: 0.98 ug/m3

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Existing Quantitative Data

FIG Priority: 8

Discussion: Existing Data of 10/2009 shows mean 0.98 ug/m3 in breathing zone samples.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1026

**AGENT** Manganese, Fume

OEL: 0.2 mg/m3

Exposure Estimate: 3.3 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing data of 10/2010 show 3.3 mg/m3.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure no

Reference:

**AGENT** Nickel, Elemental

OEL: 1 mg/m3

Exposure Estimate: 6.17 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing Data of 10/2009 show mean 6.17 mg/m3.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure no

Reference:

**Process:** Crub and Crown Plate Repair

Butt weld stainless steel plates together.

Operating Conditions:

**Task:** Welding Stainless Steel.

Frequency:

Stainless steel plates are butt welded on site. Duration and frequency are variable.

Duration:

Controls:

Local exhaust fume extractor with hood placed within 6-12 inches from work.

Recommendation:

**AGENT** Chromium VI

OEL: 5 ug/m3

Exposure Estimate: 0.98 ug/m3

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Existing Quantitative Data

FIG Priority: 8

Discussion: Hexavalent chromium in stainless and in rod (variable 310 312, 316, or wire). Existing Data of 10/2009 shows mean 0.98 ug/m3 in breathing zone samples. Conditions under which these data were collected are not known.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1910.1026

**AGENT** Manganese, Fume

OEL: 0.2 mg/m3

Exposure Estimate: 3.3 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing data of 10/2010 show 3.3 mg/m3. Duration of this task is variable.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Nickel, Elemental

OEL: 1 mg/m3

Exposure Estimate: 6.7 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing Data of 10/2009 show mean 6.17 mg/m3.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**Process:** Machine Stainless Steel Part Using Cincinnati Mill

Large stainless steel rings are machined using the Cincinnati mill to fabricate seal rings, 10ft diameter rings, and to cut down material from blanks for water wheel maintenance.

Operating Conditions:

**Task:** Milling

Frequency:

Large stainless steel rings are machined using the Cincinnati mill to fabricate seal rings, 10ft diameter rings, cut down material from blanks for water wheel maintenance. Task conducted by 3-5 machinists in HEM ranks. Duration and frequency variable

Duration:

**Controls:**

Air handler providing local exhaust with hood within 1-2 ft from cut. Exhausted air is HEPA filtered and vented to outside of adjacent door.

**Recommendation:**

<b>AGENT</b> Oil Mist	OEL:	5 mg/m3
Exposure Estimate: mg/m3	Health Effects Rating:	1 Reversible health effects of concern
Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)	Exposure Category:	Acceptable
Uncertainty: 0 Certain	Risk/Control Priority:	1
Basis: Qualitative Judgement	FIG Priority:	0
Discussion:	Oil mist from cutting oil may be generated at a concentration below level of concern during the cutting process.	

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Process:** Remove Lead Embeds

Lead packing between exposed and embedded piping is removed so that repair and maintenance work can be conducted on pipes. Lead packing is then replaced with non-lead materials. Lead embed is composed of lead poured over oakum. Oakum reportedly contains creosote. An air chisel is used to remove a section of the lead ring allowing lead and oakum to be pried out. As an alternative method, pipe is cut off at floor level then, using a grinder, the remaining pipe in the hub is cut using an abrasive wheel and caved-in with minimal disturbance of the lead. Then a corking iron is used to bend and remove lead ring.

**Operating Conditions:**

Process occurs in enclosed spaces throughout the facility.

**Task:** Remove Lead Embed, Alternate Method

Frequency: Quarterly

Pipe is cut off at floor level then, using a grinder, the remaining pipe in the hub is cut using an abrasive wheel and caved-in with minimal disturbance of the lead. Then a corking iron is used to bend and remove lead ring. This task may require one full shift plus an additional hours.

Duration: extended shift

**Controls:**

HEPA filtered portable fume extractor and HEPA filtered vacuum provide and used to control particulates. Barrier tape is used to establish control zones and control unauthorized access to immediate work area.

**Recommendation:**

**AGENT** Lead

OEL: 50 ug/m3

Exposure Estimate: ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 1 (&lt;10% OEL; 95th %tile &lt;0.1 OEL)

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 3

**Discussion:** Inhalation exposure is not likely to reach action level of 30 ug/m3 based on techniques described. An exception may occur if lead is disturbed when abrasive wheel is used to cut pipe within the hub. Dermal exposure is expected to be high. Use of hand barrier protection reportedly not used.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1025

**Process:** Repair and Fabrication of Stainless Steel Pipe

Tritool is used to cut pipe using a water-based cutting fluid. Process may include the installation of intermediate flange sets. Welding begins with an open butt which is joined with 4 tack welds using shielded metal arc.

**Operating Conditions:**

Work locations vary but are typically conducted in one of 5 individual welding shops or cells.

**Task:** Weld Stainless Steel Pipe

Frequency: Daily

Butt welds join 304/304L stainless pipe. ArcAloy 308/308L Plus rod is used for tack, root weld and filler. Rod contains 1.6% Manganese, 19.6% Chromium, and 9.7% nickel.

Duration: 4 - 8 hours

**Controls:**

Fume extractor is used with hood 12-18 inches from work.

**Recommendation:****AGENT** Chromium VI

OEL: 5 ug/m3

Exposure Estimate: 0.98 ug/m3

Health Effects Rating: 4 Life threatening or disabling injury or illness

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 8

Basis: Existing Quantitative Data

FIG Priority: 8

**Discussion:** Existing data of 10/2009 shows mean 0.98 ug/m3 in breathing zone samples for other stainless steel welding operations.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1026

**AGENT** Manganese, Fume

OEL: 0.2 mg/m3

Exposure Estimate: 3.3 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (>10% OEL; 95th %tile > OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing datafor similar tasks of 10/2010 show 3.3 mg/m3.

**Medical Surveillance** Justifiable yes  
Triggered or Critical Exposure no  
Reference:

**AGENT** Nickel, Elemental

OEL: 1 mg/m3

Exposure Estimate: 6.17 mg/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (>10% OEL; 95th %tile > OEL)

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 12

Discussion: Existing Data for similar tasks of 10/2009 show mean 6.17 mg/m3.

**Medical Surveillance** Justifiable yes  
Triggered or Critical Exposure no  
Reference:

**Process:** *Repair and Fabrication of Steel Pipe*

Tritool is used to cut pipe using a water-based cutting fluid (prepared as 6 oz product/gallon of water). Process may include the installation of intermediate flange sets. Welding begins with an open butt which is joined with 4 tack welds using shielded metal arc. The root pass is made with 6010 stick rod. The weld is then ground. The weld is then filled using shielded metal arc with 7018 rod. Pipe is cleaned-typically using a grinder--to 1 foot on both sides of the work prior to hot work.

**Operating Conditions:**

Work is typically conducted in one of 5 welding shops or cells.

**Task:** Open Butt Weld

Frequency: Daily

Open butt welds are conducted in one of the welding cells. Pipe ends are set up and aligned. Four tacks weld are made and followed by a root pass with 6010 rod. After the root pass is ground, two fill and third and final cap pass is made using 7018. Edges are then cleaned with a file and wire wheel. Four welds or more per day may be completed on 6 and 10 inch pipe

Duration: 4 - 8 hours

About 5.5 hrs actual welding time per shift

**Controls:**

Fume extractor is used with the hood within 1 foot-18inches.

**Recommendation:**

Reduce the distance between work and hood opening to 6-12 inches to improve collection efficiency of fume extractor.

**AGENT** Welding fume, NOSOEL:  mg/m3Exposure Estimate:  mg/m3Health Effects Rating:  Reversible health effects of concernExposure Rating:  (<10% OEL; 95th %tile <0.1 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Fumes from mild steel welding contain mostly iron with small amounts of additive metals (chromium, nickel, manganese, molybdenum, vanadium, titanium, cobalt, copper). Task may require extended and daily repeat exposure. Local exhaust ventilation is available for use during this task.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**Task:** Pipe "End Prep"

Frequency: Daily

Prepare end of pipe for welding using Tritool. Water soluble cutting fluid is used to cool the cut. Ten to 20 "pups" or lengths of pipe between fittings, each with two ends are cut per day. Pipe is schedule 80. Approximately 8 minutes are required per end prep. During the maintenance season (1 oct -30 may--7) 8 systems may be replaced. For example, 60 preps and welds may be made per project over a period of 2 months. Tritool is operated by compressed air.

Duration: 1 - 4 hours

Controls:

Recommendation:

**AGENT** NoiseOEL:  dBAExposure Estimate:  dBAHealth Effects Rating:  Irreversible health effects of concernExposure Rating:  (<10% OEL; 95th %tile <0.1 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Measurements of noise generation were not available for this piece of equipment.

**Medical Surveillance** Justifiable yes  
 Triggered or Critical Exposure yes  
 Reference: 29 CFR 1010.95

**AGENT** Oil MistOEL:  mg/m3Exposure Estimate:  mg/m3Health Effects Rating:  Reversible health effects of concernExposure Rating:  (<10% OEL; 95th %tile <0.1 OEL)Exposure Category: Uncertainty:  CertainRisk/Control Priority: 

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Oil mist from cutting oil may be generated at a concentration below level of concern during the cutting process.

**Medical Surveillance** Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**Process:** Replace Steel Pipe with Stainless

On-site fabrication, welding, cutting, and grinding stainless steel to replace steel corroded pipes.

**Operating Conditions:**

Fabrication typically occurs at a central location--1st floor central section. Installation is remote from shop areas. Some fitting is required on site. Work locations may include enclosed spaces such as pipe chases and trenches.

**Task:** Cut Stainless Steel with Boring Mill

**Frequency:** 2 - 3 days/wk

Cut bevel in stainless steel using milling tool. Operation requires 15 minutes per bevel. From 1 to 10 bevels are cut per day.

**Duration:** 1 - 4 hours

**Controls:**

**Recommendation:**

**AGENT** Oil Mist

**OEL:** 10 mg/m3

**Exposure Estimate:** mg/m3

**Health Effects Rating:** 1 Reversible health effects of concern

**Exposure Rating:** 1 (<10% OEL; 95th %tile <0.1 OEL)

**Exposure Category:** Acceptable

**Uncertainty:** 0 Certain

**Risk/Control Priority:** 1

**Basis:** Qualitative Judgement

**FIG Priority:** 0

**Discussion:** Potential low level exposure to oil mist from cutting fluids. TWA of 5 mg/m3 and 15 minute STEL not expected to be exceeded based on frequency and duration of exposure.

**Medical Surveillance** Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** Welding Stainless Steel: Fabrication

**Frequency:** Daily

Fabrication in stainless steel.

**Duration:** extended shift

**Controls:**

Local exhaust installed but is not used consistently.

**Recommendation:**

**AGENT** Chromium VI

**OEL:** 5 ug/m3

**Exposure Estimate:** 0.98 ug/m3

**Health Effects Rating:** 4 Life threatening or disabling injury or illness

**Exposure Rating:** 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

**Exposure Category:** Acceptable

**Uncertainty:** 1 Uncertain

**Risk/Control Priority:** 8

**Basis:** Existing Quantitative Data

**FIG Priority:** 8

**Discussion:** Hexavalent chromium in stainless and in rod (variable 310, 312, 316, or wire). Existing data of 10/2009 shows mean 0.98 ug/m3 in breathing zone samples for other related stainless steel welding operations.

**Medical Surveillance** Justifiable no  
Triggered or Critical Exposure yes  
Reference: 29 CFR 1910.1026

**AGENT** Manganese, Fume OEL: 0.2 mg/m3  
 Exposure Estimate: 3.3 mg/m3 Health Effects Rating: 3 Irreversible health effects of concern  
 Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable  
 Uncertainty: 1 Uncertain Risk/Control Priority: 12  
 Basis: Existing Quantitative Data FIG Priority: 12  
 Discussion: Existing dat of 10.2009 show mean 3.3 mg/m3 for related stainless steel welding operations.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Nickel, Elemental OEL: 1 mg/m3  
 Exposure Estimate: 6.17 mg/m3 Health Effects Rating: 3 Irreversible health effects of concern  
 Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable  
 Uncertainty: 1 Uncertain Risk/Control Priority: 12  
 Basis: Existing Quantitative Data FIG Priority: 12  
 Discussion: Existing data of 10/2009 shows mean 6.17 mg/m3 in related stainless steel welding task.

<b>Medical Surveillance</b>	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

## Police Department

**Process:** *Emergency Response Team*

Officers participate in All Risk Emergency Response Teams. Incident Command System is implemented in responses to such events as: breaches to critical infrastructure, possible explosives, and active shooters. Emergency response teams are mobilized for events lasting longer than one hour.

**Operating Conditions:**  
 Highly variable.

**Task:** Train with Flash-Bang Rounds

Participation in emergency response training at an off-site location in California exposes officers to flash-bang ordinance during training. Five rounds per student are fired.

**Frequency:** Single Event

**Duration:** <1/2 hour

**Controls:**

**Recommendation:**

**AGENT** Noise

OEL: 140 dB

Exposure Estimate: 140 dB

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 4 (&gt;10% OEL; 95th %tile &gt; OEL)

Exposure Category: Unacceptable

Uncertainty: 0 Certain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Sound level of 160 dB are reported by vendor.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

**Process:** Firearms Training

Firearms training is conducted at an on-site range. Win-Clean brand, "green" non-lead rounds are used, however, every six months duty rounds are fired. Qualification expends green ammunition in the following quantities: 9 mm--46 rounds; assault rifle--50 rounds; M4--100 rounds plus 45 rounds; pistol--100 rounds for lowlight pistol plus 100 rounds for off duty weapon qualification. Officers may also fire additional rounds during monthly open range availability.

**Operating Conditions:**

50 yd range, open air; concrete pads for shooters. Dirt berm on one side.

**Task:** Firearms Qualification and Training

Firearms training is conducted at an on-site range. Win-Clean brand, "green" non-lead rounds are used, however, every six months duty rounds are fired. Qualification expends green ammunition in the following quantities: 9 mm--46 rounds; assault rifle--50 rounds; M4--100 rounds plus 45 rounds; pistol--100 rounds for lowlight pistol plus 100 rounds for off duty weapon qualification. Officers may also fire additional rounds during monthly open range availability. Although eight lanes are available at the range, typically, only every other is used. Shooting range use and exposure may be doubled for emergency response team members.

Frequency: Monthly

Duration: 1 - 4 hours

**Controls:****Recommendation:****AGENT** Lead

OEL: 50 ug/m3

Exposure Estimate: 8 ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL)

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 6

Basis: Available Literature

FIG Priority: 6

Discussion: Exposure of shooters and instructors at other outdoor firing ranges have been shown to be in the range of non-detectable to 8 ug/m3, well below OEL and action level (see NIOSH HHE supporting document). However, potentially significant dermal exposure has been documented. In addition, significant contamination of clothing has been demonstrated. Environmental variables such as wind velocity and direction, number and composition of rounds (e.g. service vice green rounds) are expected to impact dermal and inhalation exposure potential.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1025

**AGENT** Noise

OEL: 140 dB  
 Exposure Estimate: 140 dB Health Effects Rating: 3 Irreversible health effects of concern  
 Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable  
 Uncertainty: 0 Certain Risk/Control Priority: 12  
 Basis: Existing Quantitative Data FIG Priority: 0

Discussion: Range activities typically result in exposure to impact noise exceeding 140 dB and doses exceeding 85 dBA in both indoor and outdoor ranges.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure yes  
 Reference: 29 CFR 1010.95

**Task:** Range Instructor

Frequency: Monthly

Range Instructor is responsible for safety, range control, and instruction objectives. One instructor is positioned in the tower, one on the line.

Duration: 4 - 8 hours

**Controls:**

Instructor must complete 2 week instructor accreditation training at FLETC.

**Recommendation:****AGENT** Lead

OEL: 50 ug/m3  
 Exposure Estimate: 8 ug/m3 Health Effects Rating: 3 Irreversible health effects of concern  
 Exposure Rating: 2 (10-50% OEL; 95th %tile 0.1-0.5 OEL) Exposure Category: Acceptable  
 Uncertainty: 1 Uncertain Risk/Control Priority: 6  
 Basis: Available Literature FIG Priority: 6

Discussion: Exposure of shooters and instructors at other outdoor firing ranges have been shown to be in the range of non-detectable to 8 ug/m3, well below OEL and action levels (see NIOSH HHE supporting document). However, potentially significant dermal exposure has been documented. In addition, significant contamination of clothing has been demonstrated. Environmental variables such as wind velocity and direction, number and composition of rounds (e.g. service vice green rounds) are expected to impact dermal and inhalation exposure potential.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure yes  
 Reference: 29 CFR 1910.1025

**AGENT** Noise

OEL: 140 dB  
 Exposure Estimate: 140 dB Health Effects Rating: 3 Irreversible health effects of concern  
 Exposure Rating: 4 (>10% OEL; 95th %tile > OEL) Exposure Category: Unacceptable  
 Uncertainty: 0 Certain Risk/Control Priority: 12  
 Basis: Existing Quantitative Data FIG Priority: 0

Discussion: Range activities typically result in exposure to impact noise exceeding 140 dB and doses exceeding 85 dBA in both indoor and outdoor ranges.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure yes  
 Reference: 29 CFR 1010.95

**Task:** Weapons Cleaning

Frequency: Monthly

Weapons are cleaned following each use. Break-Free and Remington lubricating oil are the products reportedly used.

Duration: <1/2 hour

Controls:

Recommendation:

**AGENT** Stoddard Solvent

OEL: 1800 ppm

Exposure Estimate: ppm

Health Effects Rating: 1 Reversible health effects of concern

Exposure Rating: 1 (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Break-Free is a solvent blend of polyalphaolefin oil; proprietary rust inhibitors, esters, and lubricants; 2-ethylhexyl acetate; and petroleum distillates. Dermatitis may occur with frequent or extended use. Remington lubricating oil contains petroleum distillates. In aerosol formulations, these products may produce respiratory irritation and central nervous system effects. Small quantities are used over short duration. OEL is 15 minute STEL which is not expected to be reached due to low volatility and quantities used. Aerosol formulations will increase inhalation of agent as mist. Barrier controls will minimize dermal exposure.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Process:** Routine Law Enforcement Operations

Routine operations may include tasks such as traffic stops and security checks, some of which may occur at off road locations, either during foot or vehicle patrols.

Operating Conditions:

Arizona, Nevada desert environments.

**Task:** Emergency Medical Treatment

Frequency: 2 - 3 days/wk

During the course of routine law enforcement patrols and operations, officers respond to medical emergencies and provide emergency medical treatment of trauma and heat injury in visitor, contractor, and employee populations. Duration is variable and dependant on the nature of the incident.

Duration: 1/2 - 1 hour

Controls:

Recommendation:

**AGENT** Bloodborne Pathogens

OEL:

Exposure Estimate:

Health Effects Rating:  Irreversible health effects of concern

Exposure Rating:  (<10% OEL; 95th %tile <0.1 OEL)

Exposure Category:

Uncertainty:  Certain

Risk/Control Priority:

Basis: Qualitative Judgement

FIG Priority:

Discussion: There is a reasonable anticipation that an officer could be occupationally exposed by skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials resulting from providing emergency medical services. Actual exposure is dependant on strict and effective use of barrier controls.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1030

# Health Risk and Further Information Gathering Priorities

## Hoover Dam

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
General Maintenance Group	Chemical stripping of paints.	Stripping Paint	Methylene chloride	Uncertain	yes	yes	16	32
Mechanical Group	Replace Steel Pipe with Stainless	Welding Stainless Steel: Fabrication	Manganese, Fume	Unacceptable	yes	no	12	12
Mechanical Group	Cavitation Repair	Welding, Metal Filling and Grinding Stainless Steel	Nickel, Elemental	Unacceptable	yes	no	12	12
Mechanical Group	Cavitation Repair	Welding, Metal Filling and Grinding Stainless Steel	Manganese, Fume	Unacceptable	yes	no	12	12
Mechanical Group	Replace Steel Pipe with Stainless	Welding Stainless Steel: Fabrication	Nickel, Elemental	Unacceptable	yes	no	12	12
Mechanical Group	Crub and Crown Plate Repair	Welding Stainless Steel.	Nickel, Elemental	Unacceptable	yes	no	12	12
Mechanical Group	Crub and Crown Plate Repair	Welding Stainless Steel.	Manganese, Fume	Unacceptable	yes	no	12	12
Mechanical Group	Repair and Fabrication of Stainless Steel Pipe	Weld Stainless Steel Pipe	Nickel, Elemental	Unacceptable	yes	no	12	12
Mechanical Group	Repair and Fabrication of Stainless Steel Pipe	Weld Stainless Steel Pipe	Manganese, Fume	Unacceptable	yes	no	12	12
General Maintenance Group	Penstock Coating	Sandblast Scroll Case	Noise	Unacceptable	yes	yes	12	12
Police Department	Firearms Training	Firearms Qualification and Training	Noise	Unacceptable	yes	yes	12	0
Police Department	Emergency Response Team	Train with Flash-Bang Rounds	Noise	Unacceptable	yes	yes	12	0
Police Department	Firearms Training	Range Instructor	Noise	Unacceptable	yes	yes	12	0
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	n-Butanol	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Trimethyl benzene	Unacceptable	yes	no	8	8
General Maintenance Group	Coating Turbine Oil Tank	Clean Surface Prior to Coating	Ethanol	Unacceptable	yes	no	8	8
Mechanical Group	Crub and Crown Plate Repair	Welding Stainless Steel.	Chromium VI	Acceptable	no	yes	8	8
General Maintenance Group	Penstock Coating	Apply Epoxy Coating Using HVLP Sprayer	Ethylbenzene	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Apply Epoxy Coating Using HVLP Sprayer	n-Butanol	Unacceptable	yes	no	8	8
Mechanical Group	Cavitation Repair	Welding, Metal Filling and Grinding Stainless Steel	Chromium VI	Acceptable	no	yes	8	8
Mechanical Group	Repair and Fabrication of Stainless Steel Pipe	Weld Stainless Steel Pipe	Chromium VI	Acceptable	no	yes	8	8

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Methyl n-amyl ketone	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	n-Butanol	Unacceptable	yes	no	8	8
Mechanical Group	Replace Steel Pipe with Stainless	Welding Stainless Steel: Fabrication	Chromium VI	Acceptable	no	yes	8	8
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Trimethyl benzene	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Methyl amyl ketone	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Apply Epoxy Coating Using HVLP Sprayer	Xylenes	Unacceptable	yes	no	8	8
General Maintenance Group	Penstock Coating	Cleanup After Blasting	Noise	Uncertain	yes	yes	6	6
General Maintenance Group	Drill Concrete Core	Core Drilling	Noise	Uncertain	yes	yes	6	6
Police Department	Firearms Training	Firearms Qualification and Training	Lead	Acceptable	no	yes	6	6
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Xylenes	Acceptable	no	no	6	6
Police Department	Firearms Training	Range Instructor	Lead	Acceptable	no	yes	6	6
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Ethylbenzene	Uncertain	yes	no	6	6
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Ethylbenzene	Acceptable	no	no	4	8
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Xylenes	Acceptable	no	no	4	4
Environmental Compliance Group	Wastewater Water Treatment Plant	General Plant Operations	Heat	Acceptable	no	no	4	4
General Maintenance Group	Clean Generator Coil	Clean Generator Coil	Asbestos	Uncertain	yes	yes	4	4
General Maintenance Group	Penstock Coating	Sandblast Scroll Case	Particulates, NOS	Unacceptable	yes	no	4	4
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Polyisocyanate Compound	Uncertain	yes	no	4	4
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Polyisocyanate compound	Uncertain	yes	no	4	4
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Polyisocyanate compound	Uncertain	yes	no	4	4
Environmental Compliance Group	Water Treatment Plant	pH Adjustment	Sulfuric acid	Acceptable	no	no	4	0
General Maintenance Group	Drill Concrete Core	Core Drilling	Silica, crystalline quartz	Acceptable	no	no	3	3
General Maintenance Group	Penstock Coating	Sandblast Scroll Case	Lead	Uncertain	yes	yes	3	3
Mechanical Group	Repair and Fabrication of Steel Pipe	Pipe "End Prep"	Noise	Uncertain	yes	yes	3	3
Mechanical Group	Remove Lead Embeds	Remove Lead Embed, Alternate Method	Lead	Uncertain	yes	yes	3	3

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Police Department	Routine Law Enforcement Operations	Emergency Medical Treatment	Bloodborne Pathogens	Acceptable	no	yes	3	0
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Kerosene	Acceptable	no	no	2	2
General Maintenance Group	Penstock Coating	Cleanup After Blasting	Particulates, NOS	Acceptable	no	no	2	2
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Ethylbenzene	Acceptable	no	no	2	0
Environmental Compliance Group	Wastewater Water Treatment Plant	Back Up Chlorination	Sodium Hypochlorite	Acceptable	no	no	2	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	n-Butanol	Acceptable	no	no	2	0
Mechanical Group	Cavitation Repair	Inspection Using Penetrating Dye	Isobutane	Acceptable	no	no	2	0
Mechanical Group	Cavitation Repair	Inspection Using Penetrating Dye	Acetone	Acceptable	no	no	2	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	trimethyl benzene	Acceptable	no	no	2	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Methyl n-amyl ketone	Acceptable	no	no	2	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Xylenes	Acceptable	no	no	2	0
General Maintenance Group	Clean Generator Coil	Clean Generator Coil	Particulates, NOS	Acceptable	no	no	1	1
Environmental Compliance Group	Wastewater Water Treatment Plant	pH Adjustment	Sodium Carbonate	Acceptable	no	no	1	1
General Maintenance Group	Penstock Coating	Apply Epoxy Coating Using HVLP Sprayer	Hydrocarbon Resin	Uncertain	yes	no	1	1
General Maintenance Group	Penstock Coating	Apply Epoxy Coating Using HVLP Sprayer	Epoxy Resin	Uncertain	yes	no	1	1
Mechanical Group	Repair and Fabrication of Steel Pipe	Open Butt Weld	Welding fume, NOS	Acceptable	no	no	1	1
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Epoxy Resin	Acceptable	no	no	1	1
General Maintenance Group	Coating Turbine Oil Tank	Apply Epoxy, Brush or Roller	Epoxy Resin	Acceptable	no	no	1	1
General Maintenance Group	Cavitation Repair Using Epoxy Filler	Expoxy Filler Application	Epoxy Resin	Acceptable	no	no	1	0
Mechanical Group	Cavitation Repair	Inspection Using Penetrating Dye	oil mist	Acceptable	no	no	1	0
Mechanical Group	Replace Steel Pipe with Stainless	Cut Stainless Steel with Boring Mill	Oil Mist	Acceptable	no	no	1	0
Mechanical Group	Machine Stainless Steel Part Using Cincinattii Mill	Milling	Oil Mist	Acceptable	no	no	1	0

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Environmental Compliance Group	Wastewater Water Treatment Plant	Dechlorination	Sodium sulfite	Acceptable	no	no	1	0
Police Department	Firearms Training	Weapons Cleaning	Stoddard Solvent	Acceptable	no	no	1	0
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Epoxy Resin	Acceptable	no	no	1	0
Police Department	Firearms Training	Weapons Cleaning	Stoddard solvent	Acceptable	no	no	1	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Kerosene	Acceptable	no	no	1	0
Environmental Compliance Group	Water Treatment Plant	Mixing Coagulant Solution	Ferric chloride	Acceptable	no	no	1	0
Mechanical Group	Cavitation Repair	Inspection Using Penetrating Dye	Naphthenic Distillate	Acceptable	no	no	1	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Epoxy Resin	Acceptable	no	no	1	0
Mechanical Group	Repair and Fabrication of Steel Pipe	Pipe "End Prep"	Oil Mist	Acceptable	no	no	1	0
General Maintenance Group	Penstock Coating	Apply Rust Converter Using Brush and Roller	Petroleum Distillate	Acceptable	no	no	0	0
General Maintenance Group	Penstock Coating	Apply Epoxy Using Airless Sprayer	Petroleum Distillate	Acceptable	no	no	0	0
General Maintenance Group	Clean Generator Coil	Clean Generator Coil	Lubricants; oil, grease	Acceptable	no	no	0	0
General Maintenance Group	Penstock Coating	Apply Rust Converter and Sealer, Brush Application	Petroleum Distillate	Acceptable	no	no	0	0
Environmental Compliance Group	Wastewater Water Treatment Plant	Macerator, Pump, and Blower Maintenance	Lubricants; oil, grease	Acceptable	no	no	0	0