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22 October 2010

CAPT Tim Radtke, CIH  
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Office of Occupational Health and Safety  
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CAPT Radtke:

I have enclosed a report of exposure assessments for the Central Region Mineral Resources Team 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 17-18 May 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: Central Region Mineral Resources Team Occupational Exposure Assessment

Central Region Mineral Resources Team  
Occupational Exposure Assessment and Medical Surveillance Inclusion  
For  
Department of Interior, Safety Council/Office of Health and Safety  
On-site: 17-18 May 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 the Central Region Mineral Resources Team was conducted on 17-18 May 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.

*Reading the Report.*

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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.

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  
22 October 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

## Central Region Mineral Resources Team

### Geology, Rock Cutting

**Process:** Rock Cutting

Saws are used to cut slabs and make cross cuts of rock samples.

Operating Conditions:

**Task:** Operate Stone Saws

Frequency:

Several models of stone saw are used in this task to cut slabs in rock specimens. Duration and frequency are project based.

Duration:

Controls:

Tools are fitted with covers which effectively control noise. The cutting process is conducted wet.

Recommendation:

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: dBA

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Acceptable

Uncertainty: 0 Certain

Risk/Control Priority: 3

Basis: Screening Measurement

FIG Priority: 0

Discussion: Screening sound level measurements were made of several saws under typical operating conditions. These tools did not produce hazardous noise.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure yes  
Reference: 29 CFR 1010.95

**AGENT** Particulates, NOC/R

OEL: 15 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: Engineering Controls in Place

FIG Priority: 0

Discussion: OEL is PEL for total fraction. Task is expected to produce fine stone particulate carried in mist.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** Operate Tile Saw

Frequency:

A tile saw is used to make cross cuts in rock samples.

Duration:

Controls:

Recommendation:

**AGENT** Noise

OEL: 85 dBA

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

Basis: Qualitative Judgement

FIG Priority: 

Discussion: Sound level and dosimetry data were not available for this task and equipment. The saw was not equipped with a noise reduction enclosure. Similar equipment can produce hazardous noise levels greatly exceeding 90 dBA. Exposure is uncertain.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

**AGENT** Particulates, NOC/ROEL:  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: OEL is PEL for total fraction. Task is expected to produce fine stone particulate carried in mist.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure no

Reference:

**Heavy Liquid Separation Laboratory****Process:** Heavy Liquid Separation

Bromoform and methylene iodide are used to separate minerals.

**Operating Conditions:**

Work is conducted in the laboratory, much of it within a laboratory hood.

**Task:** Heavy Liquid Separation

Frequency:

Duration:

Minerals are separated using bromoform or methylene iodide. Bromoform or methylene iodide density is verified using a graduated cylinder and hydrometer. Then, 500 ml of agent are poured into a separatory funnel. After 15 minutes, the petcock is opened to drain settled material. Dense minerals are washed with acetone to remove bromoform or methylene iodide. The rinsed filter is transferred to an adjacent hood equipped with a heat lamp. Additional washing with acetone may be required to remove bromoform or methylene iodide. Then the light fraction is rinsed with acetone. Agents are reused. Acetone-bromoform rinsate is temporarily stored in the flammable liquids locker until it is distilled at a later time. Spills are cleaned with acetone. Glassware is rinsed in hot water at a bench sink (not under the hood). Duration and frequency are project specific, but may require up to 8 hours per day and rarely, require two consecutive days.

**Controls:**

Work is conducted within laboratory hoods which have been checked annually to ensure a face velocity of 100 fpm.

**Recommendation:**

**AGENT** Acetone

OEL: 500 ppm

Exposure Estimate: 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: 1 Uncertain

Risk/Control Priority: 2

Basis: Engineering Controls in Place

FIG Priority: 2

Discussion: OEL is PEL. Exposure is expected to be adequately controlled by laboratory hoods.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Bromoform

OEL: 0.5 ppm

Exposure Estimate: 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: 1 Uncertain

Risk/Control Priority: 2

Basis: Engineering Controls in Place

FIG Priority: 2

Discussion: OEL is PEL. Agent is a strong irritant on inhalation and contact. Central nervous system depression, liver and kidney damage may result with ingestion. Agent has very low vapor pressure, reducing inhalation exposure risk. The greatest risk to workers will be in the event of splash or spill.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Methylene iodide

OEL: 5 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: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 4

Basis: Engineering Controls in Place

FIG Priority: 4

Discussion: OEL is PEL. Agent is a strong irritant and potential occupational carcinogen. Inhalation exposure is expected to be adequately controlled by ventilation. Skin contact is an important route of exposure. The greatest risk of exposure will result from spill or splash.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**Sample Control****Process:** Ash Plant Samples

Plant material samples are cleaned, dried, ground, and ashed. Samples may be cleaned with running water then air dried. Stems are separated. The sample is then loaded into the Wiley Mill and ground to fine powder. It is weighed and transferred to a crucible before placing it in the ashing furnace. Furnace operates at approximately 2300 degrees Celsius. It is vented with a baffled overhead canopy hood. The ashing ovens are run over night in a 36 hour sample.

Operating Conditions:

**Task:** Operate Wiley Mill

Frequency: Daily

Plant samples are ground to a fine powder using the Wiley Mill. The mill is cleaned using compressed air between samples. Prior to ashing, an aliquot is analyzed for Hg, As, and Se. Approximately 500 samples may be processed in a batch requiring approximately one month.

Duration: 4 - 8 hours

**Controls:**

Task is conducted under a hood.

**Recommendation:**

**AGENT** Arsenic, Inorganic

OEL: 10 ug/m3

Exposure Estimate:  ug/m3

Health Effects Rating:  Irreversible health effects of concern

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

Exposure Category:

Uncertainty:  Uncertain

Risk/Control Priority:

Basis: Qualitative Judgement

FIG Priority:

**Discussion:** OEL is TLV. Range of agent concentration in plant samples was not reported, but is expected to be relatively low. Work is conducted within a laboratory hood. OEL is not expected to be exceeded. Use of compressed air to clean mill may expel small quantities of sample out of the hood.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1910.1018

**AGENT** Mercury, elemental

OEL:  ug/m3

Exposure Estimate:  ug/m3

Health Effects Rating:  Irreversible health effects of concern

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

Exposure Category:

Uncertainty:  Uncertain

Risk/Control Priority:

Basis: Qualitative Judgement

FIG Priority:

**Discussion:** OEL is TLV. Range of agent concentration in plant samples was not reported, but is expected to be relatively low. Work is conducted within a laboratory hood. OEL is not expected to be exceeded. Use of compressed air to clean mill may expel small quantities of sample out of the hood.

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

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate:  dBAHealth Effects Rating:  Irreversible health effects of concernExposure Rating:  (50-100% OEL; 95th %tile 0.5-1.0 OEL)Exposure Category: Uncertainty:  UncertainRisk/Control Priority: 

Basis: Screening Measurement

FIG Priority: 

**Discussion:** Representative screening sound level measurements made within the laboratory during this task demonstrated all levels below 83 dBA with one exception. The sound level was measured as 100.2 dBA while compressed air was being used for cleaning. As demonstrated, the use of compressed air was limited to a few seconds per sample. At this level, a maximum dose would be achieved in 12 minutes. Cleaning using compressed air is expected to be the major contributor to dose during this task. However, OEL is not expected to be exceeded under the conditions reported.

<b>Medical Surveillance</b>	Justifiable	no
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1010.95

**AGENT** Particulates, NOC/ROEL:  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:** OEL is PEL for total particulates. Risk due to potential for allergenic response to plant based particulates. Smoke demonstrated good air movement into the hood at 2 ft from the face. However, uncertainty is due to use of compressed air for cleaning which is expected to force some particulate out of the hood. OEL is not expected to be exceeded.

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

**AGENT** Selenium

OEL: 0.2 mg/m3

Exposure Estimate:  mg/m3Health Effects Rating:  Severe, 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:** OEL is TLV. Agent is an essential trace element. Over exposure may result in eye, nose, throat, and skin irritation. Chronic over exposure may result in a broad range of health impacts. Range of agent in plant samples was not reported, but is expected to be relatively low. Work is conducted within a laboratory hood. OEL is not expected to be exceeded. Use of compressed air to clean mill may expel small quantities of sample out of the hood.

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

**Process:** Sample Preparation

Water, soils, sediment, rock, and plant samples are received and prepared for analysis. Samples are received from around the world and reportedly may contain known hazardous agents such as mercury, biological agents, asbestos, arsenic, or anthrax, or may contain unknown agents.

**Operating Conditions:**

Work is conducted under laboratory conditions.

**Task:** Operate Hand Grinder

**Frequency:** Monthly

**Duration:** 4 - 8 hours

A hand grinder is used when sample size is not adequate to process using other methods or when a sample requires special handling that can be accommodated with this equipment. Task requires operation of a slow speed automated mortar and pestle requiring approximately 25 minutes per sample. The number of samples processed is project dependant but typically 12 samples are processed. The sample is transferred to weighing paper by inverting the mortar over it. The paper is then rolled up resulting in little sample disturbance. Following each sample, equipment is blown with compressed air under a laboratory hood and then cleaned with acetone.

**Controls:**

Task is conducted on bench top, with exception of cleaning which is conducted within a laboratory hood.

**Recommendation:**

**AGENT** Acetone

**OEL:** 500 ppm

**Exposure Estimate:** 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:** OEL is TLV. Small quantities of agent are used to moisten a cleaning pad. As much as 500 ml may be used during a week of continuous sample processing.

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

**Task:** Operate Large Ball Mill

**Frequency:**

**Duration:**

Operate the large ball mill to grind minerals to less than 200 mesh (60 u) size using alumina balls. An 800 pound sample may require a week, grinding about 100 pounds per day. To clean the mill, a vacuum with its exhaust directed into the hood is used, followed by grinding 50 pounds of silica quartz, followed by water washing and air drying. Compressed air is not used for cleaning. Alumina balls are washed in a sink.

**Controls:**

Ball mill fits within an enclosed hood. Face velocity above the access to the mill was in the range of 30-45 fpm. Below that level, the velocity was as low as 18-20 fpm.

**Recommendation:**

**AGENT** Noise

OEL: 85 dBA

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

Basis: Screening Measurement

FIG Priority: 

Discussion: Screening sound level measurement demonstrated 82.7 dBA at 4 ft from the face of the enclosing hood. Duration of exposure is limited.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	yes
	Reference:	29 CFR 1010.95

**AGENT** Particulates, NOC/ROEL:  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: OEL is PEL. Greatest exposure is expected during transfer of processed material.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Silica, crystalline quartz

OEL: 25 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: OEL is TLV. A large quantity of silica quartz ground to less than 60 um. Particle size distribution was not reported. Reference for OEL is a cut point of 3.5-4 um. Greatest exposure risk will occur during removal of quartz used in cleaning.

Medical Surveillance	Justifiable	yes
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Operate Large Jaw Crusher

Frequency: Daily

Using a large rock crusher, sample rock is crushed down to 10 mm size. The equipment is cleaned with compressed air and a brush. Acetone may also be used to clean the crusher between samples; most often when processing soil samples. Approximately 5-10 ml of acetone is used per sample when used. Typically 40 samples are processed in a day. Frequency and duration are variable and based on project requirements.

Duration: 1/2 - 1 hour

**Controls:**

Equipment is set up near, but outside of the hood. A fan is used to "push" any dust generated toward the hood.

**Recommendation:**

**AGENT** Acetone

OEL: 500 ppm

Exposure Estimate: 74 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: 0 Certain

Risk/Control Priority: 4

Basis: Mathematical Modeling

FIG Priority: 0

Discussion: OEL is TLV. Based on quantities used, duration of use, and dilution from one or more ventilation systems in operation during this task, OEL is not expected to be exceeded.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: 84.8 dBA

Health Effects Rating: 3 Irreversible 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: 9

Basis: Screening Measurement

FIG Priority: 9

Discussion: Screening sound level measurements made during the simulated task showed levels between 86 and 92 dBA in the center of the sample preparation room while the jaw crusher was operating. At 92 dBA, the allowable dose will be exceeded in 1.6 hours. Task duration was reported as 1/2 to 1 1/2 hours. Exposure rating is based on this task alone. Other tasks conducted during the shift will contribute to dose and likely result in the OEL being exceeded.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure yes  
 Reference: 29 CFR 1010.95

**AGENT** Particulates, NOC/R

OEL: 15 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: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Fine dust that is not expected to be well controlled by the existing ventilation system may be released into the sample preparation room in small quantities.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 3

Discussion: OEL is TLV for respirable fraction. Crystalline silica content of samples is variable. Fine dust that is not expected to be well controlled by the existing ventilation system may be released into the sample preparation room in small quantities.

Medical Surveillance Justifiable yes  
Triggered or Critical Exposure no  
Reference:

**Task:** Operate Shatter Box (Puck and Disk) Pulverizer

Frequency: Daily

An alumina puck and disk are used to pulverize 2 oz samples for 9-12 minutes. The sample is then transferred to a hood, poured into pan and then poured through the Jones splitter. After loading and before removing the sample, the operator leaves the space. At the completion of the task the disk and puck are cleaned under a hood using compressed air.

Duration: 4 - 8 hours

**Controls:**

The pulverizer operates within a sealed cabinet but without ventilation.

**Recommendation:**

**AGENT** Particulates, NOC/R

OEL: 15 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: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: OEL is PEL for total dust. The greatest risk of dust release is during cleaning and when using the Jones splitter, during which unknown quantities escape the hood, especially when using compressed air to clean equipment and surfaces. Duration may be up to 4 hours.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**AGENT** Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/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: Engineering Controls in Place

FIG Priority: 3

Discussion: OEL is TLV for respirable fraction. Small quantities of fine dust are expected to escape the hood when using compressed air to clean equipment and surfaces.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** Operate Sieve Shaker

Frequency: Bi-Monthly

The "Rototap" sieve shaker processes pulverized sample through a series of 5 stacked sieves. The operation requires 12 minutes per sample. Sieves are cleaned in an adjacent hood using a brush and compressed air. Frequency is project dependant. Task may require multiple full shift days per project.

Duration: 4 - 8 hours

Controls:

Recommendation:

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: 89 dBA

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: Screening Measurement

FIG Priority: 0

Discussion: Screening sound level measurement demonstrated that 89 dBA is generated by this equipment during this task. Full shift exposure at this level will result in a dose of 264% of the maximum.

**Medical Surveillance**

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

**AGENT** Particulates, NOC/R

OEL: 15 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: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Fine dust is released during this task. Much of it is controlled by existing ventilation. However, unknown quantities escape the hood during the task, especially when using compressed air to clean equipment and surfaces.

**Medical Surveillance**

Justifiable no

Triggered or Critical Exposure no

Reference:

**Task:** Operate Small Jaw Crusher

Frequency: Daily

Operate Braun jaw crusher to grind samples to "fine gravel size. Equipment is cleaned between samples using compressed air. Acetone may be used infrequently to clean equipment.

Duration: 1/2 - 1 hour

Controls:

Task is conducted within a hood. Face velocity of the hood is checked annually with target face velocity of 100 fpm. Use of eye and respiratory protection is not consistent among operators. Work is conducted within a laboratory hood. A smoke generator used to demonstrate hood capture efficacy showed that the overhead HVAC exhaust overcomes the face velocity at approximately 1 ft from the face.

Recommendation:

**AGENT** Acetone

OEL: 500 ppm

Exposure Estimate: 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: Engineering Controls in Place

FIG Priority: 0

Discussion: OEL is TLV. Small quantities of agent are reportedly used infrequently during this task. Work with agent is conducted within a laboratory hood.

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

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: dBA

Health Effects Rating: 3 Irreversible 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: 9

Basis: Qualitative Judgement

FIG Priority: 9

Discussion: Based on the reported duration, and assuming sound levels of 92 dBA, the OEL is not expected to be exceeded. However, a number of other tasks involving noise hazardous equipment will contribute to worker dose.

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

**AGENT** Particulates, NOC/R

OEL: 15 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: Engineering Controls in Place

FIG Priority: 0

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Fine dust generated during this task is expected to be well controlled by the existing ventilation system. However, small quantities of dust are expected to escape the hood when using compressed air to clean equipment and surfaces. OEL is not expected to be exceeded during this task.

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

**AGENT** Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: 1 ug/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: Engineering Controls in Place

FIG Priority: 3

Discussion: OEL is TLV for respirable fraction. Crystalline silica content of samples is variable. Fine dust generated during this task is expected to be well controlled by the existing ventilation system. However, small quantities of fine dust are expected to escape the hood when using compressed air to clean equipment and surfaces.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**Task:** Operate Soil Disaggregator

Frequency: Daily

The soil disaggregator is used to processes approximately 2 Kg of soil per sample. Each sample requires 15 minutes to process. The equipment is cleaned with compressed air after each sample. Acetone will be used to clean the equipment after approximately 40% of samples.

Duration: 4 - 8 hours

Controls:

The equipment is operated within a makeshift enclosure with exhaust ventilation below the screen and at rear-left side of the enclosure. This enclosure reportedly does not effectively control visible dust generated in the process. There are several competing exhaust hoods in the space. Face velocity at just above the mortar was measured as <40 fpm.

Recommendation:

**AGENT** Acetone

OEL: 500 ppm

Exposure Estimate: 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: OEL is TLV. Quantities of agent used were not reported. Existing ventilation is expected to adequately control agent.

Medical Surveillance	Justifiable	no
	Triggered or Critical Exposure	no
	Reference:	

**AGENT** Noise

OEL: 85 dBA  
 Exposure Estimate: 86 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: Screening Measurement FIG Priority: 12

Discussion: Screening sound level measurements made during this task demonstrate sound levels of approximately 86 dBA. Duration of task is up to full shift. Under these conditions a dose of 126 % of the maximum is estimated.

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

**AGENT** Particulates, NOC/R

OEL: 15 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: 2 Highly Uncertain Risk/Control Priority: 1  
 Basis: Qualitative Judgement FIG Priority: 2

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Worker reports and screening measurement identify inefficiencies in the existing ventilation system. Unknown quantities of dust are expected to escape the hood during this task and especially when using compressed air to clean equipment and surfaces.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**Task:** Use Jones Splitter

Frequency: Daily

A Jones spitter is used to reduce the working sample size to at least 3 oz. Compressed air is used to clean equipment between samples.

Duration: 1 - 4 hours

**Controls:**

Work is conducted under a laboratory hood.

**Recommendation:****AGENT** Particulates, NOC/R

OEL: 15 mg/m3  
 Exposure Estimate: mg/m3 Health Effects Rating: 1 Reversible 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: 2  
 Basis: Qualitative Judgement FIG Priority: 2

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Fine dust is released during this task. Much of it is controlled by existing ventilation. However, unknown quantities escape the hood during the task, especially when using compressed air to clean equipment and surfaces. Duration may be up to 4 hours.

Medical Surveillance Justifiable yes  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/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 TLV for respirable fraction. Crystalline silica content of samples is variable. Fine dust generated during this task is generally expected to be well controlled by the existing ventilation system. However, small quantities of fine dust are expected to escape the hood when using compressed air to clean equipment and surfaces.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**Task:** Vertical Pulverizer

Frequency: Daily

Duration: 1 - 4 hours

Approximately 3 oz of sample are loaded into a Braun Sample Grinder (vertical pulverizer). One half ounce of silica sand and compressed air are used to clean equipment and surfaces between samples. Three ounces of sand will be used between sample lots. Rarely, acetone will be used to clean equipment after soils are processed. Waste material dropped into a waste can below the hood (through an opening in the hood, through a tube, and into a waste can). Gaps in this disposal system allow dust to escape from under the hood. The task requires 10 minutes per sample. Typically, 30 samples are processed per day.

**Controls:**

Work is conducted within a laboratory hood. A smoke generator used to demonstrate hood capture efficacy showed that the overhead HVAC exhaust overcomes the face velocity at approximately 1 ft from the face.

**Recommendation:**

**AGENT** Acetone

OEL: 500 ppm

Exposure Estimate: 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: Engineering Controls in Place

FIG Priority: 0

Discussion: OEL is TLV. Based of quantity of agent used, frequency of use (limited to between jobs or lots), and existing ventilation, OEL is not expected to be exceeded.

Medical Surveillance Justifiable no  
Triggered or Critical Exposure no  
Reference:

**AGENT** Noise

OEL: 85 dBA

Exposure Estimate: 87.7 dBA

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: Screening Measurement

FIG Priority: 0

Discussion: A screening sound level measurement made during this task demonstrated 90.7 dBA while grinding sand. With a reported duration of up to 4 hours, a dose of 186 % of the maximum is estimated.

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

**AGENT** Particulates, NOC/R

OEL: 15 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: Engineering Controls in Place

FIG Priority: 0

Discussion: OEL is PEL for total dust. Another appropriate OEL is PEL for respirable fraction (5 mg/m3). Fine dust generated during this task is generally expected to be well controlled by the existing ventilation system. However, small quantities of dust are expected to escape the hood when using compressed air to clean equipment and surfaces. OEL is not expected to be exceeded during this task.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

**AGENT** Silica, crystalline quartz

OEL: 25 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: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 3

Discussion: OEL is TLV for respirable fraction. Small quantities of fine dust are expected to escape the hood when using compressed air to clean equipment and surfaces. Washed quartz sand is used for cleaning. Particle size estimates were reported for sand after processing as: 30% passing through a 200 mesh (75 u) sieve; "a good percentage" of that passing through a 375 mesh (43 u) sieve.

Medical Surveillance Justifiable no  
 Triggered or Critical Exposure no  
 Reference:

# Health Risk and Further Information Gathering Priorities

## Central Region Mineral Resources Team

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Geology, Rock Cutting	Rock Cutting	Operate Tile Saw	Noise	Uncertain	yes	yes	12	12
Sample Control	Sample Preparation	Operate Soil Disaggregator	Noise	Unacceptable	yes	yes	12	12
Sample Control	Sample Preparation	Operate Sieve Shaker	Noise	Unacceptable	yes	yes	12	0
Sample Control	Sample Preparation	Vertical Pulverizer	Noise	Unacceptable	yes	yes	12	0
Sample Control	Sample Preparation	Operate Small Jaw Crusher	Noise	Uncertain	yes	yes	9	9
Sample Control	Ash Plant Samples	Operate Wiley Mill	Noise	Acceptable	no	yes	9	9
Sample Control	Sample Preparation	Operate Large Jaw Crusher	Noise	Acceptable	no	yes	9	9
Heavy Liquid Separation Laboratory	Heavy Liquid Separation	Heavy Liquid Separation	Methylene iodide	Acceptable	no	no	4	4
Sample Control	Sample Preparation	Operate Large Jaw Crusher	Acetone	Acceptable	no	no	4	0
Sample Control	Sample Preparation	Vertical Pulverizer	Silica, crystalline quartz	Acceptable	no	no	3	3
Sample Control	Sample Preparation	Operate Shatter Box (Puck and Disk) Pulverizer	Silica, crystalline quartz	Acceptable	no	no	3	3
Sample Control	Sample Preparation	Use Jones Splitter	Silica, crystalline quartz	Acceptable	no	no	3	3
Sample Control	Sample Preparation	Operate Large Ball Mill	Silica, crystalline quartz	Uncertain	yes	no	3	3
Sample Control	Sample Preparation	Operate Small Jaw Crusher	Silica, crystalline quartz	Acceptable	no	no	3	3
Sample Control	Ash Plant Samples	Operate Wiley Mill	Arsenic, Inorganic	Acceptable	no	yes	3	3
Sample Control	Sample Preparation	Operate Large Jaw Crusher	Silica, crystalline quartz	Uncertain	yes	no	3	3
Sample Control	Ash Plant Samples	Operate Wiley Mill	Mercury, elemental	Acceptable	no	no	3	3
Geology, Rock Cutting	Rock Cutting	Operate Stone Saws	Noise	Acceptable	no	yes	3	0
Sample Control	Sample Preparation	Operate Large Ball Mill	Noise	Acceptable	no	yes	3	0
Sample Control	Sample Preparation	Use Jones Splitter	Particulates, NOC/R	Uncertain	yes	no	2	2
Heavy Liquid Separation Laboratory	Heavy Liquid Separation	Heavy Liquid Separation	Bromoform	Acceptable	no	no	2	2
Heavy Liquid Separation Laboratory	Heavy Liquid Separation	Heavy Liquid Separation	Acetone	Acceptable	no	no	2	2
Sample Control	Sample Preparation	Operate Soil Disaggregator	Acetone	Acceptable	no	no	2	0
Sample Control	Sample Preparation	Operate Small Jaw Crusher	Acetone	Acceptable	no	no	2	0
Sample Control	Sample Preparation	Vertical Pulverizer	Acetone	Acceptable	no	no	2	0

Division, Shop, Project	Process	Task	Agent	Exposure Category	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Sample Control	Sample Preparation	Operate Hand Grinder	Acetone	Acceptable	no	no	2	0
Sample Control	Ash Plant Samples	Operate Wiley Mill	Selenium	Acceptable	no	no	2	0
Sample Control	Sample Preparation	Operate Soil Disaggregator	Particulates, NOC/R	Uncertain	yes	no	1	2
Sample Control	Sample Preparation	Operate Shatter Box (Puck and Disk) Pulverizer	Particulates, NOC/R	Acceptable	no	no	1	1
Sample Control	Ash Plant Samples	Operate Wiley Mill	Particulates, NOC/R	Acceptable	no	no	1	1
Geology, Rock Cutting	Rock Cutting	Operate Tile Saw	Particulates, NOC/R	Acceptable	no	no	1	1
Sample Control	Sample Preparation	Operate Large Jaw Crusher	Particulates, NOC/R	Acceptable	no	no	1	1
Sample Control	Sample Preparation	Operate Large Ball Mill	Particulates, NOC/R	Uncertain	yes	no	1	1
Sample Control	Sample Preparation	Operate Sieve Shaker	Particulates, NOC/R	Acceptable	no	no	1	1
Sample Control	Sample Preparation	Vertical Pulverizer	Particulates, NOC/R	Acceptable	no	no	1	0
Sample Control	Sample Preparation	Operate Small Jaw Crusher	Particulates, NOC/R	Acceptable	no	no	1	0
Geology, Rock Cutting	Rock Cutting	Operate Stone Saws	Particulates, NOC/R	Acceptable	no	no	1	0