David P. Bleicher, MS., MSPH
Certified Industrial Hygienist
8136 Snipe Court
Juneau, Alaska 99801
(907) 321-4931
David@BleicherCIH.com

28 November 2010

CAPT Tim Radtke, CIH
Department of the Interior
Office of Occupational Health and Safety
755 Parfet Street
Suite 364
Lakewood, CO 80215

CAPT Radtke:

I have enclosed a report of exposure assessments for Grand Canyon National Park 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 18-19 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/DoIeA4TR.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: Grand Canyon National Park Occupational Exposure Assessment

Grand Canyon National Park
Occupational Exposure Assessment and Medical Surveillance Inclusion
For
Department of Interior, Safety Council/Office of Health and Safety
On-site: 18-19 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[1].

An on-site visit to Grand Canyon National Park was conducted on 18-19 March 2010 by David P. Bleicher, CIH to characterized 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.

[1] Bullock, Wm.H. and J.S.Ignacio, Eds. 2006. A Strategy for Assessing and Managing Occupational Exposures, 3rd. 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 categorized 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
28 November 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

Grand Canyon National Park

Facility Management Division

Process: *Cyclic Trail Maintenance*

Cyclic trail maintenance requires clearing ditches and water bars, moving dirt and soil back onto tred, and replacing trail tred. Process may require use of Pionjar portable rock drill to break up dirt. Manual tasks include the use of shovels, picks, McLeod, and wheel barrows. Process is typically conducted in the spring, but may occur at any time of the year.

Operating Conditions:

Process is conducted inside the canyon.

Task: General Cyclic Maintenance

Frequency: Daily

Duration: 4 - 8 hours

Task may require clearing ditches and water bars, moving dirt and soil back onto tread, or replacing trail tread using manual methods including the use of shovel, pick, McLeod, and wheel barrows.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is high. Task duration is long. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

AGENT Repetitive Motion

OEL:

Exposure Estimate:

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 6

Discussion: Musculo-skeletal strain was reported as an issue of concern by workers for a number of trail construction tasks. NIOSH investigators investigating MSDs at Yosemite NP concluded that the job tasks associated with building and maintaining hiking trails at Yosemite National Park include many ergonomic stress factors that can lead to musculoskeletal disorders of the back and upper and lower extremities.

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. Exposure during this task is not expected to exceed the OEL. However, other tasks which may be conducted in conjunction with this task may generate elevated concentrations of agent and contribute to exposure of concern.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Operate Chain Saw

Frequency: Daily

Duration: 4 - 8 hours

Chain saws are used on the North rim to clear fallen trees, often as a result of snow loads over winter, strong winds, or fire damage. Work is typically conducted in the spring (late April through early May). Work is conducted over two "tours" during a period of one month. Species are primarily ponderosa pine but may include some aspen. Typically 4 tanks of fuel are consumed per day per saw.

Controls:

Chain saw safety course trained.

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: Unacceptable

Uncertainty: 0 Certain

Risk/Control Priority: 3

Basis: Existing Quantitative Data

FIG Priority: 0

Discussion: Manufacturer and model of saws were not determined. Sound level data for other similar equipment have demonstrated hazardous noise at greater than 109 dBA. At this level permissible dose will be exceeded in less than 2 minutes.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

AGENT Wood dust, all other species

OEL: 1 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 TLV TWA Inhalable. Duration of this task was reportedly long--between 4-8 hours. Although fine particulate may be generated, properly sharpened and operated chain saws tend to produce larger sized chips. OEL is not expected to be exceeded. In general, workers exposed to wood dusts have experienced a variety of adverse health effects such as eye and skin irritation, allergy, reduced lung function, asthma, and nasal cancer.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Operate Portable Rock Drill/Jack Hammer

Frequency:

Duration: 4 - 8 hours

Operate portable gasoline engine powered rock drill/jack hammer to loosen compacted soils prior to shoveling. Work is conducted dry. Equipment is Pionjar brand. Task requires daily, full shifts, during the cyclic maintenance project. Single individuals may operate equipment for a maximum of 3 hours during a shift.

Controls:

A rotation schedule is employed which limits operation to a maximum of 3 hours per employee during a shift. Operators rotate after each tank of gasoline.

Recommendation:

AGENT Carbon Monoxide

OEL: 200 ppm

Exposure Estimate: ppm

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: OEL is REL-C. Approximately 1 quart of gasoline and oil in a 12:1 mix was reportedly burned during the full sift. Peak exposure may approach the OEL infrequently and for very short periods.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is moderate. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Use of

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

Exposure Category: Unacceptable

Uncertainty: 0 Certain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 0

Discussion: Sound level or dosimetry data were not available for this task. This equipment is expected to generate hazardous noise in the range of 95 to over 100 dBA. Duration of task is long.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

AGENT Repetitive Motion

OEL:

Exposure Estimate:

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: Musculo-skeletal strain was reported as an issue of concern by workers for a number of trail construction tasks. NIOSH investigators investigating MSDs at Yosemite NP concluded that the job tasks associated with building and maintaining hiking trails at Yosemite National Park include many ergonomic stress factors that can lead to musculoskeletal disorders of the back and upper and lower extremities.

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: OEL is TLV. Exposure data were not available for this task. The aggressive operation is expected to generate particulate concentrations of concern. Duration of task is long.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

AGENT Ultraviolet radiation

OEL: 3 mj/cm2

Exposure Estimate: mj/cm2

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 12

Discussion: Actinic UV exposure to skin can result in sunburn, carcinogenesis, and photosensitization. Eye exposure can result in photokeratitis and cataract generation. Prolonged outdoor work by employees increases risk of health impact. Use of personal barrier protections such as long sleeved shirts, wide brimmed hats, and sun screen are uncertain. Quantitative exposure data was not available for this and similar tasks.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

AGENT Vibration, Hand Arm

OEL: 4 m/s2

Exposure Estimate: m/s2

Health Effects Rating: 1 Reversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 8

Discussion: OEL is TLV for total daily exposure of 4-8 hours. Data were not available for this task.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

Process: *General Custodial Operations*

Public buildings and common areas of NPS occupied buildings and facilities are cleaned. Minor repairs and maintenance, such as replacing light bulbs or minor plumbing repairs (flush meters, diaphragms, repair minor leaks), are conducted.

Operating Conditions:

Task: General Cleaning Using Powered Equipment

Frequency: Daily

Duration: <1/2 hour

Vacuum and spot carpet cleaners are used to clean carpeted floors.

Controls:

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: Existing Quantitative Data

FIG Priority: 0

Discussion: Sound level or dosimetry data were not available for this task. However, sound level monitoring has demonstrated sound levels below 81 dBA for several similar tools. Task duration is reported as less than 1/2 hour.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Task: General Custodial Cleaning Operations

Frequency: Daily

Duration: 1 - 4 hours

Task involves wet cleaning and mopping with disinfectant solutions. Solutions are mixed on site.

Controls:

Recommendation:

AGENT Ammonium Chloride Compounds

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: Product is Citra-Cide which is moderately corrosive and may damage eyes and skin. Greatest health risk is due to eye and skin contact with concentrated product. Uncertainty is due to lack of eye protection during handling of concentrated product.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: General Custodial, Wet Cleaning Toilet

Frequency: Daily

Duration: <1/2 hour

When cleaning toilets, Formula 66 product is added to detergent and disinfectant cleaning solution. Product may also be added full strength to sinks, water free urinals, conventional urinals, and floor drains.

Controls:

Recommendation:

AGENT Propietary Compound

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: Available Literature

FIG Priority: 1

Discussion: Product active ingredient is a proprietary enzymatic digester. The manufacturer reports in the MSDS that inhalation exposure may result in allergic reactions when inhaled, produce severe irritation to eye, and eye infection. Eye protection is not utilized when handling this product.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Process: *Service Compositing and Dehydrating Vault Toilets*

Photovoltaic composting and dehydrating vault toilets are serviced and cleaned. Dehydrating toilets are "exchanged" annually. Composting toilets are emptied every 1-4 years.

Operating Conditions:

Task: Clean River Bags and Dehydrating Toilets

Frequency:

Duration:

River bags used to collect and transfer human waste within the canyon and dehydrating toilets are cleaned at an unused sludge drying bed at the wastewater treatment plant. A three bucket wash system is used to clean and disinfect bags. A hose and solutions of detergent (Super Green product) and bleach are used to manually clean toilets. Approximately 500 bags are clean in a year with 50-60 bags cleaned in a session requiring approximately 4.5 hours. Eleven toilets may be cleaned per year with a maximum or 3 per day, each requiring approximately 2 hours.

Controls:

Task is only conducted by workers that have received tetanus and HBV vaccination.

Recommendation:

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: OEL is WEEL-C. Agent is a strong irritant. Contact with undiluted bleach solution (10%) through spill or splash presents the greatest risk to employees. Barrier protection is reported.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Exchange Dehydrating Toilet

Frequency:

Duration: <1/2 hour

Dehydrating toilets are exchanged in their entirety using a helicopter which delivers them directly to the waste transfer facility. There is no direct contact with waste material. Dust is generated by the helicopter. The toilet is delivered to the waste transfer site (see associated task described under solid waste transfer). Waste is manually shoveled into the loader at the transfer site by 2 trails workers. The consistency of the waste is highly variable and was described as ranging from raw untreated human waste to dried or composted human waste mixed with wood chips.

Controls:

Task is only conducted by workers that have received tetanus and HBV vaccination.

Recommendation:

AGENT Human waste products

OEL:

Exposure Estimate:

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

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

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 2

Basis: Qualitative Judgement

FIG Priority: 2

Discussion: Exposure to infectious agents is low during this task. Exposure is primarily via the oral route. Fungal agents associated with composted waste which can cause allergic reactions may be present. However, the potential risk of exposure is expected to be low and is of short duration. Risk of HBV transmission is considered negligible based on task description and available literature on exposure risk to sanitation workers. Primary risk reduction method is good personal hygiene which is presumed for this assessment.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

AGENT Particulates, NOC/R

OEL: 15 mg/m3

Exposure Estimate: 0 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: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 2

Basis: Qualitative Judgement

FIG Priority: 2

Discussion: OEL is PEL for total dust. High dust exposure which includes a crystalline silica component is expected as a result of working near helicopter operations in field situations. Task duration is short and occurs infrequently. Other tasks involving high particulate exposure or helicopter operations may contribute to higher employee exposures were not included in this profile.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: Service and Clean Composting Toilets

Frequency: 2 - 3 days/wk

Duration: 1/2 - 1 hour

Composting toilets on corridor trails are serviced and cleaned. Stalls are swept, mopped, and cleaned using a Simple Green product. Toilet seats and other contact surfaces are disinfected using a household bleach solution. Wood chips and a bacterial enzyme product are added once per week. The compost is turned with tines activated by an external crank. The hatch is opened to remove trash using a trash picker and placed into a plastic bag. The compost may be further mixed with a hoe. The task is conducted seasonally during the spring, summer, and fall.

Controls:

Recommendation:

AGENT Human Waste Products

OEL:

Exposure Estimate:

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: Exposure to infectious agents is low during this task. Exposure is primarily via the oral route. Fungal agents associated with composted waste which can cause allergic reactions may be present. However, the potential risk of exposure is expected to be low and is of short duration. Risk of HBV transmission is considered negligible based on task description and available literature on exposure risk to sanitation workers. Primary risk reduction method is good personal hygiene which is presumed for this assessment.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

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: OEL is WEEL-C. A working 10% bleach solution is prepared and applied using a sponge. Agent is corrosive to skin and eyes. Use of hand and eye protection (safety glasses) was reported.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Service and Clean Dehydrating Toilets

Frequency: Bi-Annually

Duration: <1/2 hour

Dehydrating toilets are cleaned and serviced at remote backcountry locations. A manure rake is used to turn waste and mix wood chips. Spot cleaning is conducted using a solution of Simple Green cleaner. Task requires hiking to access toilets. Each toilet is serviced every 2-3 years by trails staff or canyon rangers. Toilets are located at 11 sites. Task is conducted primarily in spring and fall.

Controls:

Vaccination for tetanus and hepatitis A and B are provided.

Recommendation:

AGENT Human Waste Products

OEL:

Exposure Estimate:

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: Exposure to infectious agents is low during this task. Exposure is primarily via the oral route. Fungal agents associated with composted waste that can cause allergic reactions may be present. However, the potential risk of exposure is expected to be low and is of short duration. Risk of HBV transmission is considered negligible based on task description and the literature on exposure of sanitation workers. Primary risk reduction method is good personal hygiene which is presumed for this assessment.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Process: *Snow Removal, Custodial*

Custodial staff remove snow from public areas on the rim and some sections of trails using shovels, a Polaris 6x6 UTV with plow attachment, snow blowers, and bobcat.

Operating Conditions:

Conducted when there are at least 2 inches of snow on the ground.

Task: Operate Bobcat, Snow Removal

Frequency:

Duration: 4 - 8 hours

A Bobcat with plow attachment is used to clear snow from around dumpsters and pedestrian pathways around the village. Task may be repeated 3 to 10 times per year.

Controls:

Task is conducted in a heated, enclosed cab.

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: 1 Uncertain

Risk/Control Priority: 3

Basis: Existing Quantitative Data

FIG Priority: 3

Discussion: Sound level and dosimetry data are not available for this specific piece of equipment or task. However, screening sound level measurements at the operating position of similar equipment (Bobcat) with open cab (no load) showed potential exposure to 82 dBA. Uncertainty is due to unknown sound levels in this equipment, under load, and inside a cab enclosure. Reported use of hearing protectors during this task suggests the perception of hazardous noise exposure. Task duration is up to a full shift.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Task: Operate Polaris with Snow Plow

Frequency:

Duration: 1 - 4 hours

Polaris 6 X 6 UTV with snow plow attachment is used to remove snow from public areas on the rim and on some sections of trail. Task may be repeated 3 to 10 times per season.

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: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 6

Basis: Qualitative Judgement

FIG Priority: 6

Discussion: Sound level and dosimetry data are not available for this task. Properly operating equipment of this type is not expected to produce high hazardous noise during normal operation. Task requires less than 1/2 shift.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Task: Operate Snow Blower

Frequency:

Duration: 1 - 4 hours

Snow blower is operated 2-3 times per year to remove snow from public areas on the rim and on some sections of trail.

Controls:

Recommendation:

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: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 9

Basis: Qualitative Judgement

FIG Priority: 9

Discussion: Sound level and dosimetry data are not available for this task. Properly operating equipment of this type may approach 85 dBA. Hearing protectors are reportedly worn suggesting the recognition of exposure to hazardous noise. Task requires less than 1/2 shift.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Process: *Solid Waste Collection and Transfer*

Solid waste is collected and transported to the "wet dump" transfer station. Dumpsters are emptied using a top load compactor. Also, trash is removed from 30 gal flip top cans manually. Garbage has been collected in plastic bag-lined containers and is not directly handled. Workers tie bags and load them into the compactor truck. At the transfer station loads are dumped on ground, and then loaded into an open-topped semi trailer using bucket loader plus one individual with leaf rake on the ground. A contractor hauls the trailer, delivering it to an off-site landfill. Bagged, but leaking, undigested material from wastewater treatment plant is loaded into the bucket loader by wastewater treatment plant workers. Sanitation workers then load this waste into the trailer. Trails crew members deliver composted or dried human waste from canyon vault toilets. This waste is received in bags or 55 gallon drums. Trails crew load the loader bucket. The sanitation crew then empties the waste into the semi trailer.

Operating Conditions:

Task: Clean Rodent Feces and Nest Material from Trash Enclosures

Frequency: Weekly

Duration: <1/2 hour

Contaminated surfaces and nesting material are saturated with sodium hypochlorite solution dispensed from a manual spray bottle after which material is shoveled and the enclosure swept using a broom and dust pan. Collected material is placed in a plastic bag and disposed of. Task occurs seasonally; primarily in the spring and into summer.

Controls:

Recommendation:

AGENT Hantavirus

OEL:

Exposure Estimate:

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: Qualitative Judgement

FIG Priority: 0

Discussion: Rodent nests within trash enclosures are reportedly encountered weekly requiring removal. In the United States, Hantavirus cases are most prevalent in Colorado, Arizona, and New Mexico. Procedures reported for exposure control when removing nesting material or cleaning contaminated surfaces are expected to provide adequate control. Cleaning as soon as rodent activity is identified is expected to prevent gross contamination and reduce risk.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

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: OEL is WEEL-C and is not expected to be exceeded during this task or in the related task of mixing the working solution. Skin contact with concentrated product during the related task of mixing stock solution can result in severe irritant effects.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Collect Solid Waste, Manual

Frequency: Daily

Duration: extended shift

Solid waste is collected from 30 gallon top load “flip top" garbage cans in public areas. Bagged waste is manually removed and loaded into a side load compactor truck. Truck loads are then transferred to the "wet dump" transfer station. Abundant mouse activity, feces, and nesting material at the transfer station were reported. Bags may be compacted in order to close the top of the bag. During the winter, the collection route requires 6 hours.

Controls:

Hepatitis B vaccination is provided.

Recommendation:

AGENT Bloodborne Pathogens

OEL:

Exposure Estimate:

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: Risk of needle stick from improperly disposed of syringes is conceivable when manually compacting bags and has been reported to have occurred at other facilities during similar tasks. It was reported that no needle sticks in sanitation workers have occurred in the past five or more years at this facility. Risk of disease transmission is very low for sanitation and custodial worker occupations. An OSHA interpretive letter states that workers designated to collect and dispose of found needles should be considered "occupationally exposed" according to 29CFR1919.1030.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1910.1030

AGENT Hantavirus

OEL:

Exposure Estimate:

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: Qualitative Judgement

FIG Priority: 0

Discussion: Rodent nests within trash enclosures are reportedly encountered weekly requiring removal. Hantavirus cases are most prevalent in the states of Colorado, Arizona, and New Mexico. Reported procedures for exposure control when removing nesting material or cleaning contaminated surfaces are expected to provide adequate control.

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: Sound level and dosimetry data are not available for this task. Hearing protectors (muffs) are worn occasionally in the truck. Operation of the compactor reportedly generates high sound levels. Task occurs over an extended workshift.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Task: Operate Top Load Compactor Truck

Frequency: Daily

Duration: 4 - 8 hours

Dumpsters are emptied using the top load compactor truck. No direct contact with waste occurs. Duration is full shift. Mouse or other rodent activity is reportedly encountered within the cab of the truck weekly.

Controls:

Recommendation:

AGENT Hantavirus

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: As reported, there is regular exposure to rodent feces and urine. Use of procedures described in the related task of cleaning trash enclosures is presumed. Gross contamination of the vehicle was not reported.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

AGENT Noise

OEL:

Exposure Estimate:

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: Sound level and dosimetry data are not available for this task.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Task: Solid Waste Transfer

Frequency: 2 - 3 days/wk

Duration: 1 - 4 hours

Truck loads of solid waste are transferred at the "wet dump" transfer station. Loads are dumped on the ground. Then, with a bucket loader, and one employee with a leaf rake on the ground to rake and consolidate trash that has escaped from bags, waste is loaded into an open topped semi trailer. When full, the trailer is hauled away by a contractor for delivery to the landfill. Contact with splashed and dripping liquids was reported for loader operator. The operation reportedly generates significant dust in the summer months.

Controls:

The loader is equipped with an enclosed, heated and air conditioned cab.

Recommendation:

AGENT Bloodborne Pathogens

OEL:

Exposure Estimate:

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: As reported, the task is not expected to result in direct contact with needles, blood or other infectious material.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1910.1030

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: 1 Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 3

Discussion: Sound level and dosimetry data are not available for this task. When closed and properly functioning enclosed cabs are fitted on similar heavy equipment, hazardous noise is typically adequately controlled. Uncertainty is due to unreported manufacturer and model of loader, use and function of cab, and position of employee on the ground during loader operation.

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: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: OEL is PEL for total fraction. Task reportedly generates significant dust exposure during summer months. Properly functioning and used loader cab is expected to adequately control particulates for the loader operator. Particulate exposure for the employee on the ground has not been evaluated, but is not expected to exceed the OEL.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Solid Waste Transfer, Wastewater Treatment Plant Bar Screen Waste a

Frequency: 2 - 3 days/wk

Duration: 1/2 - 1 hour

Undigested material from wastewater treatment plan that has been bagged is loaded into the loader bucket by wastewater treatment plant workers. The load is then transferred to the open topped semi trailer by sanitation workers. Trails crew deliver composted or dried human waste from canyon vault toilets and load into the loader bucket. This waste is received in bags or 55 gallon drums. Sanitation crew empties into semi trailer. The 5 gallon drums are opened and the contents are poured into the loader bucket. Reportedly, approximately 1/3 of the drum is liquid urine with the bottom 2/3 composed of compacted feces. Bar screen material is transferred 1-3 days per week while compost is transferred monthly.

Controls:

Recommendation:

Transfer of waste as described for this task suggests the potential for direct exposure to human waste on an unpleasant scale which is not addressed in the literature for sanitation worker occupations. Further assessment of this task may be warranted.

AGENT Bloodborne Pathogens

OEL:

Exposure Estimate:

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: Direct contact with needles, blood, or other infectious material is not anticipated during this task.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure yes

Reference: 29 CFR 1910.1030

AGENT Human Waste Products

OEL:

Exposure Estimate:

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

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 8

Basis: Available Literature

FIG Priority: 16

Discussion: The literature supports the conclusion that risk of human disease transmission in wastewater treatment plant and sanitation is low. However, transfer of waste as described for this task suggests the potential for direct exposure to human waste on an unpleasant scale.

Medical Surveillance

Justifiable: yes

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: 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: Sound level and dosimetry data are not available for this task. When closed and properly functioning enclosed cabs are fitted on similar heavy equipment, hazardous noise is typically adequately controlled. Task duration is short. Uncertainty is due to unreported manufacturer and model of loader, use and function of cab, and position of employees on the ground during loader operation.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

Process: *Trail Construction*

Trails are repaired, rehabilitated and constructed in the canyon and on the rim. Process may include rock cutting, rock shaping, and rock crushing using powered and hand tools. Task durations are given as maximums. Approximately 50% of the year is spent on construction, 50% on cyclic maintenance.

Operating Conditions:

Work is conducted in sandstone and limestone formations and may also involve granite, gneiss, schist and shale.

Task: Crush Stone, Manually

Frequency: Daily

Duration: 1/2 - 1 hour

Rock and stone are crushed manually to develop support material for stone placement. Task is conducted using single (4lbs) or douple (8lbs) jack sledge hammers. Task occurs daily during projects which may occur 15% of the crew's time.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is moderate to high. Task duration is less than 1 hour. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

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

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 12

Discussion: OEL is for continuous noise. OEL of 140 dB for impact noise may apply to this task. Exposure data are not available for this task.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

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. Exposure duration is short for this task. However, other tasks which generate crystalline silica may be conducted during the shift and contribute to an exposure of concern.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: Hiking Within the Canyon

Frequency: Daily

Duration: 1 - 4 hours

Workers travel to and from the worksite by walking. Trails are steep and conditions are hot and dry. Workers tend to be very fit and well acclimated. Workers may be required to hike 8-14miles to a base location, after which they will hike up to 2 miles to daily work locations. Hikes are typically paced at 3 miles per hour.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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

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

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 16

Basis: Existing Quantitative Data

FIG Priority: 16

Discussion: Metabolic heat generation is very high during this task. Employees involved in this task are typically fit and acclimated. However, heart rate monitoring during canyon assent has demonstrated unacceptable heat strain.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

Task: Manual Dirt Work

Frequency: Daily

Duration: 4 - 8 hours

Dirt, soils, and crushed rock are moved manually and placed on trails with the assistance of wheel barrows, shovels, and a Muck Truck motorized wheel barrow.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is high. Task duration is long. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Manual Shaping of Stone

Frequency: Daily

Duration: 1 - 4 hours

Stone is shaped manually using a 4 pound single jack hammer and chisel. Task requires 1-2 hours per day.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is moderate. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

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

Exposure Category: Unacceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 12

Discussion: OEL is for continuous noise. OEL of 140 dB for impact noise may apply to this task. Exposure data are not available for this task.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

AGENT Silica, crystalline quartz

OEL:

Exposure Estimate: 0

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. Exposure duration is short for this task. However, other tasks which generate crystalline silica may be conducted during the shift and contribute to an exposure of concern.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: Operate Chain Saw, Juniper Harvest

Frequency: Daily

Duration: 4 - 8 hours

Operate chain saw to harvest juniper logs. Task requires 6 hours per day for approximately 2 months every 2 years. Some shaping of logs may be conducted.

Controls:

Recommendation:

AGENT Carbon Monoxide

OEL: 25 ppm

Exposure Estimate: ppm

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: OEL is TLV. Approximately 1 gallon of gas and oil in a 50: 1 mix is burned during the 6 hour task. Exposure is not expected to exceed the OEL. Approximately one quart of bar oil is reportedly used which may result in incidental dermal exposure of little concern.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task is typically conducted in the spring or fall thus avoiding the worst of the extreme hot and dry conditions which can occur at this facility. Metabolic heat generation is moderate. Workers tend to be fit and well acclimated.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

AGENT Juniper oil/sap

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: Rashes were reported and attributed to exposure to juniper oil and sap.

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

Exposure Category: Unacceptable

Uncertainty: 0 Certain

Risk/Control Priority: 12

Basis: Existing Quantitative Data

FIG Priority: 0

Discussion: Manufacturer and model of tools were not determined. Sound level data for other similar equipment have demonstrated hazardous noise at greater than 109 dBA. At this level permissible dose will be exceeded in less than 2 minutes.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

Task: Operate Chain Saw, Trail Construction

Frequency: Daily

Duration: <1/2 hour

Chain saw is operated to cut juniper logs for trail construction features such as water bars and checks. Task is short duration, requiring operation of saw to trim logs for fitting and installation. Task may occur 4 times in a typical day. Task occurs daily for the North rim crew over a period of 4 months and occurs infrequently in the canyon.

Controls:

Recommendation:

AGENT Noise

OEL: 85 dBA

Exposure Estimate: 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: Existing Quantitative Data

FIG Priority: 0

Discussion: Manufacturer and model of tools were not determined. Sound level data for other similar equipment have demonstrated hazardous noise at greater than 109 dBA. At this level permissible dose will be exceeded in less than 2 minutes.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

Task: Operate Electric Rotary Drill

Frequency: Daily

Duration: 1 - 4 hours

Operate electric rotary drill to drill holes and shape rock. Tool is powered by a portable Honda 1000 gasoline powered generator. Task may be conducted daily during construction projects involving rock work.

Controls:

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is low to moderate. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Use of half face APR may increase heat retention somewhat. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: Sound level and dosimetry data were not available for this task. Sound level produced by properly maintained and operated generator is not expected to contribute significantly to dose, especially when kept at a distance from the rotary drill work. Sound level generated by the drill is not known but is anticipated to be noise hazardous.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

AGENT Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: OEL is TLV. Exposure data were not available for this task. Low OEL, long duration exposure over extended shifts, high crystalline silica rock formations and aggressive, dry drilling are expected to generate particulate concentrations of concern. Exposure from this task, combined with exposure from other tasks conducted during the shift, may result in exposures of concern.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: no

Reference:

Task: Operate Mobile Rock Crusher

Frequency: Daily

Duration: 1 - 4 hours

Operate the 2000 pound diesel powered mobile rock crusher. Rock crusher is on tracks and is transported to worksite by helicopter. Stones are gathered by hand to load the crushing basket using wheel barrows. Equipment operates for a maximum of 6 hours per day. Workers are on 9 hour shifts. Frequency is project dependant. As an example, a project may require operation of the rock crusher every day for 1 week. Task requires one operator-loader.

Controls:

Operators are rotated daily or at mid day. Environmental heat stress factors are routinely monitored.

Recommendation:

AGENT Heat

OEL:

Exposure Estimate:

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

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

Exposure Category: Acceptable

Uncertainty: 1 Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 12

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is moderate to high. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Use of half face APR may increase heat retention somewhat. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

AGENT Nitrogen Dioxide

OEL: 3 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: 1 Uncertain

Risk/Control Priority: 1

Basis: Qualitative Judgement

FIG Priority: 1

Discussion: OEL is TLV. Oxides of nitrogen are irritant products of diesel engine combustion and may be used as a surrogate for qualitative diesel engine exhaust exposure.

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: 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 and dosimetry data were not available for this task. High level hazardous noise is anticipated and recognized by workers. Double hearing protection is reportedly worn.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

AGENT Repetitive Motion

OEL:

Exposure Estimate:

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 3

Basis: Qualitative Judgement

FIG Priority: 6

Discussion: Musculo-skeletal strain was reported as an issue of concern by worker for a number of trail construction tasks. Analysis to identify stressors and risk was not conducted or available for this task.

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: OEL is TLV. Exposure data were not available for this task. Low OEL, long duration exposure over extended shifts, high crystalline silica rock formations and aggressive crushing are expected to generate particulate concentrations of concern.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: no

Reference:

Task: Operate Portable Rock Drill/Jack Hammer

Frequency: Daily

Duration: 1/2 - 1 hour

Operate portable gasoline engine powered rock drill/jack hammer to drill holes and shape stone. All work is conducted dry. Equipment is Pionjar brand.

Controls:

There is reportedly a move to minimize the use of the Piojar and substitute it with the electric drill.

Recommendation:

AGENT Carbon monoxide

OEL: 200 ppm

Exposure Estimate: ppm

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: OEL is REL-C. Approximately 1 quart of gas and oil in a 12: 1 mix is burned during the 0.5 to 1 hour task. Peak exposures may approach the OEL infrequently and for very short periods.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

AGENT Heat

OEL:

Exposure Estimate:

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: Task may be conducted under extreme hot and dry conditions. Metabolic heat generation is moderate. Workers tend to be fit and well acclimated. Environmental heat stress factors are routinely monitored. Use of half face APR may increase heat retention somewhat. Wearing cotton shirts soaked with water is an effective technique for enhancing evaporative cooling that is reportedly used.

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: 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 or dosimetry data were not available for this task. This equipment is anticipated to generate hazardous noise in the range of 95 to over 100 dBA during operation. At 100 dBA, the allowable dose will be exceeded in approximately 20 minutes. Task reportedly requires 0.5 to 1 hour.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure yes

Reference: 29 CFR 1010.95

AGENT Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Uncertain

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: OEL is TLV. Exposure data were not available for this task. Aggressive operation is expected to generate particulate concentration of concern. Task is relatively short in duration. However, exposure from this task, combined with exposure from other tasks conducted during the shift, may result in unacceptable exposure.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

AGENT Vibration, Hand Arm

OEL: 12 m/s2

Exposure Estimate: m/s2

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 TLV for total daily exposure of less than 1 hour. Data were not available for this task.

Medical Surveillance

Justifiable yes

Triggered or Critical Exposure no

Reference:

Task: Operate Rock Saw

Frequency: Daily

Duration: 1/2 - 1 hour

Operate the gasoline engine powered rock saw equipped with a 14-16 inch diamond-tipped saw blade to cut and shape rock. Saw is used without water attachment. This tool is not used in the inner canyon.

Controls:

Recommendation:

AGENT Carbon Monoxide

OEL: 200 ppm

Exposure Estimate: ppm

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Qualitative Judgement

FIG Priority: 4

Discussion: OEL is REL-C. Approximately 1 quart of gas and oil in a 50: 1 mix is burned during the 0.5 to 1 hour task. Peak exposures may approach the OEL infrequently and for very short periods.

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

Exposure Category: Unacceptable

Uncertainty: 0 Certain

Risk/Control Priority: 12

Basis: Screening Measurement

FIG Priority: 0

Discussion: Sound level data available for similar equipment showed hazardous noise may generated at greater than 109 dBA. At this level the OEL will be exceeded in less than 2 minutes.

Medical Surveillance

Justifiable: yes

Triggered or Critical Exposure: yes

Reference: 29 CFR 1010.95

AGENT Silica, crystalline quartz

OEL: 25 ug/m3

Exposure Estimate: ug/m3

Health Effects Rating: 3 Irreversible health effects of concern

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

Exposure Category: Acceptable

Uncertainty: 2 Highly Uncertain

Risk/Control Priority: 12

Basis: Qualitative Judgement

FIG Priority: 24

Discussion: OEL is TLV. Exposure data were not available for this task. Aggressive operation is expected to generate particulate concentration of concern. Task is relatively short in duration. However, exposure from this task, combined with exposure from other tasks conducted during the shift, may result in unacceptable exposure.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Process: *Wastewater Treatment Plant Operation*

The South rim wastewater treatment plant is a tertiary treatment and reclamation system.

Operating Conditions:

Task: Add Soda Ash to Influent

Frequency: Daily

Duration: <1/2 hour

Bags of soda ash are slit and the contents are dumped through a grate above the discharge from the grit chamber (inflow to aeration chambers). Task may be repeated during the shift requireing up to four 50 pound bags be handled per shift.

Controls:

Recommendation:

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 powered 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 use was reported, but eye protection was not.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: Bar Screen and Grit Bagging

Frequency: Daily

Duration: <1/2 hour

Unregulated waste is removed from the mechanical bar screen rake and grit pumped from grit chamber is loaded into plastic bags. Bags are collected, sealed and deposited into a small dump trailer for delivery to the landfill transfer site. For bar screen material, the bag is taped closed then loaded onto a wheeled cart and dumped into the dump trailer. Grit is loaded into smaller bags which are also taped and then lifted and placed into the dump trailer. One bag each of grit and bar screen material is handled per day.

Controls:

Recommendation:

AGENT Human Waste Products

OEL:

Exposure Estimate:

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: Available Literature

FIG Priority: 0

Discussion: Wastewater treatment plant workers may be exposed to infectious bacteria and parasites in raw sewage which, if transmitted, may result in gastro-intestinal illness. Route of transmission is oral. Risk is limited. Risk of HAV is not elevated in wastewater treatment plant and sanitation workers.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Task: Change Cl2 Cylinders

Frequency: 2 - 3 days/wk

Duration: <1/2 hour

Chlorine gas cylinders are changed. Cylinders are 140 pounds empty and 250 pounds when filled. Approximately 3 cylinders are changed per week. Task requires valve to be closed followed by a wait to allow evacuation of the tube. Then the locking clamp is released and the cap and lid replaced. To attach a fresh cylinder the procedure is reversed. The seal is checked with an ammonia leak detector.

Controls:

The cylinder is contained within an isolated, ventilated space. Task procedures require the buddy system which is absolutely enforced.

Recommendation:

AGENT Chlorine

OEL: 0.5 ppm

Exposure Estimate: ppm

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: 1 Uncertain

Risk/Control Priority: 4

Basis: Engineering Controls in Place

FIG Priority: 4

Discussion: OEL is REL-C. Engineering controls and strictly enforced procedures account for low risk during normal operations. Greatest risk will result from accidental uncontrolled release in which case emergency response procedures will be implemented. The facilities chlorine gas release emergency response plan was not evaluated.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Load Bulk Coagulant Storage Tank

Frequency: Monthly

Duration: 4 - 8 hours

An electric pump is used to transfer polymeric anticoagulant product from 55 gallon durms into the storge tank. There is no direct contact with the liquid product. MSDS is not available for this product. The final quantities, approximately 9 gallons in the drum, are poured manually. Aluminum sulfate may be used as an alternative coagulant in the process.

Controls:

Recommendation:

AGENT Aluminum sulfate

OEL: 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: 1 Uncertain

Risk/Control Priority: 2

Basis: Qualitative Judgement

FIG Priority: 2

Discussion: Agent hydrolyzes with water producing sulfuric acid which results in strong corrosive effects when in contact with eyes and mucous membranes. Reported barrier protection was limited to gloves. Agent was reportedly used as an alternative to a product described as a polymeric coagulant HB 104C manufactured by the AnTerra Group of Laguna Hills, Ca. An MSDS could not be located. Uncertainty is due to handling procedures and quantity used.

Medical Surveillance

Justifiable no

Triggered or Critical Exposure no

Reference:

Task: Sample Mixed Liquor

Frequency: Daily

Duration: 1 - 4 hours

Mixed liquor is sampled using long handled dippers. Sample is poured into a beaker and then placed in carrier and delivered to the laboratory. Sampling is conducted daily and requires approximately 2 hours. In addition, every 5 days, "full lab" samples are collected which requires approximately 4 hours.

Controls:

Personal hygiene.

Recommendation:

AGENT Human Waste Products

OEL:

Exposure Estimate:

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: Wastewater treatment plant workers may be exposed to infectious bacteria and parasites in raw sewage which, if transmitted, may result in gastro intestinal illness. Route of transmission is oral. Risk is limited. Risk of HAV is not elevated in wastewater treatment plant and sanitation workers.

Medical Surveillance

Justifiable: no

Triggered or Critical Exposure: no

Reference:

Health Risk and Further Information Gathering Priorities

Grand Canyon National Park

Division, Shop, Project	Process	Task	Agent	Exposure Catagory	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Facility Management Division	Trail Construction	Hiking Within the Canyon	Heat	Unacceptable	yes	no	16	16
Facility Management Division	Trail Construction	Operate Rock Saw	Silica, crystalline quartz	Acceptable	no	no	12	24
Facility Management Division	Solid Waste Collection and Transfer	Collect Solid Waste, Manual	Noise	Uncertain	yes	yes	12	24
Facility Management Division	Trail Construction	Operate Mobile Rock Crusher	Silica, crystalline quartz	Uncertain	yes	no	12	24
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Repetitive Motion	Uncertain	yes	no	12	24
Facility Management Division	Trail Construction	Operate Electric Rotary Drill	Noise	Uncertain	yes	yes	12	24
Facility Management Division	Trail Construction	Operate Electric Rotary Drill	Silica, crystalline quartz	Uncertain	yes	no	12	24
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Silica, crystalline quartz	Uncertain	yes	no	12	24
Facility Management Division	Trail Construction	Operate Portable Rock Drill/Jack Hammer	Silica, crystalline quartz	Uncertain	yes	no	12	24
Facility Management Division	Trail Construction	Manual Shaping of Stone	Noise	Unacceptable	yes	yes	12	12
Facility Management Division	Trail Construction	Crush Stone, Manually	Noise	Unacceptable	yes	yes	12	12
Facility Management Division	Trail Construction	Operate Mobile Rock Crusher	Heat	Acceptable	no	no	12	12
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Ultraviolet radiation	Uncertain	yes	no	12	12
Facility Management Division	Trail Construction	Operate Portable Rock Drill/Jack Hammer	Noise	Unacceptable	yes	yes	12	12
Facility Management Division	Trail Construction	Operate Mobile Rock Crusher	Noise	Unacceptable	yes	yes	12	12
Facility Management Division	Trail Construction	Operate Rock Saw	Noise	Unacceptable	yes	yes	12	0
Facility Management Division	Trail Construction	Operate Chain Saw, Trail Construction	Noise	Unacceptable	yes	yes	12	0
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Noise	Unacceptable	yes	yes	12	0
Facility Management Division	Trail Construction	Operate Chain Saw, Juniper Harvest	Noise	Unacceptable	yes	yes	12	0
Facility Management Division	Snow Removal, Custodial	Operate Snow Blower	Noise	Acceptable	no	yes	9	9
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer, Wastewater Treatment Plant Bar Screen Waste and Vault Toilet Compost	Human Waste Products	Uncertain	yes	no	8	16

Division, Shop, Project	Process	Task	Agent	Exposure Catagory	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Facility Management Division	Snow Removal, Custodial	Operate Polaris with Snow Plow	Noise	Acceptable	no	yes	6	6
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Vibration, Hand Arm	Uncertain	yes	no	4	8
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Heat	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Chain Saw, Juniper Harvest	Carbon Monoxide	Acceptable	no	no	4	4
Facility Management Division	Cyclic Trail Maintenance	Operate Portable Rock Drill/Jack Hammer	Carbon Monoxide	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Crush Stone, Manually	Heat	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Chain Saw, Juniper Harvest	Heat	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Manual Shaping of Stone	Heat	Acceptable	no	no	4	4
Facility Management Division	Solid Waste Collection and Transfer	Operate Top Load Compactor Truck	Hantavirus	Acceptable	no	no	4	4
Facility Management Division	Cyclic Trail Maintenance	General Cyclic Maintenance	Heat	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Rock Saw	Carbon Monoxide	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Portable Rock Drill/Jack Hammer	Carbon monoxide	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Portable Rock Drill/Jack Hammer	Heat	Acceptable	no	no	4	4
Facility Management Division	Wastewater Treatment Plant Operation	Change Cl2 Cylinders	Chlorine	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Operate Electric Rotary Drill	Heat	Acceptable	no	no	4	4
Facility Management Division	Trail Construction	Manual Dirt Work	Heat	Acceptable	no	no	4	4
Facility Management Division	Solid Waste Collection and Transfer	Clean Rodent Feces and Nest Material from Trash Enclosures	Hantavirus	Acceptable	no	no	4	0
Facility Management Division	Solid Waste Collection and Transfer	Collect Solid Waste, Manual	Hantavirus	Acceptable	no	no	4	0
Facility Management Division	Cyclic Trail Maintenance	General Cyclic Maintenance	Repetitive Motion	Uncertain	yes	no	3	6
Facility Management Division	Trail Construction	Operate Mobile Rock Crusher	Repetitive Motion	Uncertain	yes	no	3	6
Facility Management Division	Trail Construction	Manual Shaping of Stone	Silica, crystalline quartz	Acceptable	no	no	3	3
Facility Management Division	Trail Construction	Crush Stone, Manually	Silica, crystalline quartz	Acceptable	no	no	3	3
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer, Wastewater Treatment Plant Bar Screen Waste and Vault Toilet Compost	Bloodborne Pathogens	Acceptable	no	yes	3	3

Division, Shop, Project	Process	Task	Agent	Exposure Catagory	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer, Wastewater Treatment Plant Bar Screen Waste and Vault Toilet Compost	Noise	Acceptable	no	yes	3	3
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer	Noise	Acceptable	no	yes	3	3
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer	Bloodborne Pathogens	Acceptable	no	yes	3	3
Facility Management Division	Solid Waste Collection and Transfer	Operate Top Load Compactor Truck	Noise	Uncertain	yes	yes	3	3
Facility Management Division	Solid Waste Collection and Transfer	Collect Solid Waste, Manual	Bloodborne Pathogens	Acceptable	no	yes	3	3
Facility Management Division	Snow Removal, Custodial	Operate Bobcat, Snow Removal	Noise	Acceptable	no	yes	3	3
Facility Management Division	Cyclic Trail Maintenance	General Cyclic Maintenance	Silica, crystalline quartz	Acceptable	no	no	3	3
Facility Management Division	General Custodial Operations	General Cleaning Using Powered Equipment	Noise	Acceptable	no	yes	3	0
Facility Management Division	Cyclic Trail Maintenance	Operate Chain Saw	Noise	Unacceptable	yes	yes	3	0
Facility Management Division	Wastewater Treatment Plant Operation	Load Bulk Coagulant Storage Tank	Aluminum sulfate	Acceptable	no	no	2	2
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Exchange Dehydrating Toilet	Human waste products	Acceptable	no	no	2	2
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Exchange Dehydrating Toilet	Particulates, NOC/R	Acceptable	no	no	2	2
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Clean River Bags and Dehydrating Toilets	Sodium hypochlorite	Acceptable	no	no	2	0
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Service and Clean Composting Toilets	Human Waste Products	Acceptable	no	no	2	0
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Service and Clean Composting Toilets	Sodium Hypochlorite	Acceptable	no	no	2	0
Facility Management Division	Service Compositing and Dehydrating Vault Toilets	Service and Clean Dehydrating Toilets	Human Waste Products	Acceptable	no	no	2	0
Facility Management Division	Solid Waste Collection and Transfer	Clean Rodent Feces and Nest Material from Trash Enclosures	Sodium hypochlorite	Acceptable	no	no	2	0
Facility Management Division	Wastewater Treatment Plant Operation	Bar Screen and Grit Bagging	Human Waste Products	Acceptable	no	no	2	0
Facility Management Division	Wastewater Treatment Plant Operation	Sample Mixed Liquor	Human Waste Products	Acceptable	no	no	2	0
Facility Management Division	Trail Construction	Operate Portable Rock Drill/Jack Hammer	Vibration, Hand Arm	Uncertain	yes	no	1	2

Division, Shop, Project	Process	Task	Agent	Exposure Catagory	Justified Medical Surveillance	Triggered Surveillance	Health Risk Priority	FIG Priority
Facility Management Division	Wastewater Treatment Plant Operation	Add Soda Ash to Influent	Sodium carbonate	Acceptable	no	no	1	1
Facility Management Division	General Custodial Operations	General Custodial, Wet Cleaning Toilet	Propietary Compound	Acceptable	no	no	1	1
Facility Management Division	Solid Waste Collection and Transfer	Solid Waste Transfer	Particulates, NOC/R	Acceptable	no	no	1	1
Facility Management Division	Trail Construction	Operate Mobile Rock Crusher	Nitrogen Dioxide	Acceptable	no	no	1	1
Facility Management Division	Cyclic Trail Maintenance	Operate Chain Saw	Wood dust, all other species	Acceptable	no	no	1	1
Facility Management Division	Trail Construction	Operate Chain Saw, Juniper Harvest	Juniper oil/sap	Acceptable	no	no	1	1
Facility Management Division	General Custodial Operations	General Custodial Cleaning Operations	Ammonium Chloride Compounds	Acceptable	no	no	1	1