Hanford Site Hazards Guide

Fall 2013
# Hanford Site Hazards Guide

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Cover photo: Laliik (Rattlesnake Mountain) on the Hanford Site, the place where the Wanapum Prophet Smohalla went searching for answers so he could save his people during his vision quest.
ASBESTOS

Summary:
Two OSHA Asbestos Standards apply at the Hanford Site. 29 CFR 1926.1101 covers construction work, including alteration, repair, renovation, and demolition of structures containing asbestos. 29 CFR 1910.1001 applies to asbestos exposure in general industry, such as exposure during brake and clutch repair, custodial work, and manufacture of asbestos-containing products. Hanford Contractors have company-specific programs for this hazard. Other regulatory requirements (e.g., EPA, State) may apply depending on the nature of the work and the potential for contaminating the environment (i.e., air, water, soil).

The construction standard classifies the hazards of asbestos work activities and prescribes particular requirements for each classification:

- **Class I** is the most potentially hazardous class of asbestos work and involves the removal of thermal system insulation and sprayed-on or troweled-on asbestos-containing materials or presumed asbestos-containing materials.
- **Class II** includes the removal of other types of asbestos-containing materials that are not thermal system insulation, such as resilient flooring and roofing materials containing asbestos.
- **Class III** focuses on repair and maintenance operations where asbestos-containing or presumed asbestos-containing materials are disturbed.
- **Class IV** pertains to custodial activities where employees clean up asbestos-containing waste and debris.

Exposure Monitoring: In construction work, unless the contractor is able to demonstrate that employee exposures will be below the Permissible Exposure Limit (PEL), a “negative exposure assessment,” is generally required to conduct daily monitoring for workers in Class I and II regulated areas. For workers in other operations where exposures are expected to exceed one of the limits, periodic monitoring is required. In general industry, initial monitoring is required for workers who may be exposed above a PEL or above the excursion limit. Subsequent monitoring must be conducted at reasonable intervals, and in no case at intervals greater than 6 months for employees exposed above a PEL.

**Exposure Limits and Controls:**

<table>
<thead>
<tr>
<th>OSHA PEL</th>
<th>OSHA Excursion Limit - 30 min (EL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 f/cc</td>
<td>1.0 f/cc</td>
</tr>
</tbody>
</table>

Contractors must control exposures at or below the exposure limits using engineering controls and work practices to the extent feasible. Where feasible engineering controls and work practices do not ensure worker protection at the exposure limits, the contractor must reduce employee exposures to the lowest levels achievable, then supplement them with respiratory protection to meet the exposure limits. In construction, each work classification has specific control method requirements. In general industry, specific controls are prescribed for brake and clutch repair work. For example, the use of compressed air to remove asbestos must be prohibited.

For any employee exposed to airborne concentrations of asbestos that exceed a PEL, contractors must provide and require the use of respirators and protective clothing, such as coveralls or similar full-body clothing, head coverings, gloves, and foot coverings. Contractors must provide face shields, vented goggles, or other appropriate protective equipment wherever the possibility of eye irritation exists and require workers to wear them. Contractors must establish decontamination areas and hygiene practices for employees exposed above a PEL. In addition, employees may not smoke in work areas that might expose them to asbestos.
Training: In construction, contractors must provide training for employees exposed above a PEL and for employees involved in each identified work classification. The specific training requirements depend upon the particular class of work being performed. In general industry, training must be provided to all employees exposed above a PEL. Asbestos awareness training must be provided to employees who perform housekeeping operations covered by the standard.

Medical: In construction, contractors must provide medical examinations for workers who, for 30 or more days per year, engage in Class I, II, or III work or experience exposure above a PEL. In general industry, contractors must provide medical examinations for workers who are exposed above a PEL.

Regulations driven by 10 CFR 851:*  
29 CFR 1910.1001, Asbestos  
29 CFR 1926.1101, Asbestos  

*Some other WAC and EPA codes may apply
BERYLLIUM

Summary:
The DOE Beryllium Rule 10 CFR 850 establishes a Chronic Beryllium Disease Prevention Program (CBDPP). The rule applies to DOE offices and contractors with operations or activities that involve present or past exposure or potential for exposure to beryllium at DOE facilities. It also applies to any current DOE or contractor employee who is or was exposed or potentially exposed at a DOE facility. The Rule does not cover beryllium articles and DOE laboratory operations that meet the definition of laboratory use of hazardous chemicals in 29 CFR 1910.1450. The standard establishes maximum limits of exposure to beryllium for all workers covered, including an airborne permissible exposure limit (PEL) and action level (AL). The Hanford CBDPP is comprehensive, establishes a more conservative airborne action level, and includes surface contamination levels and controls not included in the Rule.

The Rule and the Hanford CBDPP address the following requirements:

✓ Baseline beryllium inventory and hazard assessment
✓ Permissible exposure limit and an action level
✓ Exposure monitoring* (initial and periodic*), reduction and minimization
✓ Regulated areas*
✓ Hygiene facilities and practices*
✓ Respiratory protection, protective clothing and equipment*
✓ Housekeeping, release criteria and waste disposal
✓ Beryllium emergencies
✓ Medical surveillance, consent and removal provisions
✓ Training and counseling
✓ Warning signs and labels*
✓ Recordkeeping and use of information
✓ Performance feedback

*The employer must implement these elements if an airborne concentration of beryllium is ≥ the action level.

Hanford Contractors are required to implement the Hanford CBDPP, DOE-0342. Some Contractors have company-specific implementing programs describing their process. DOE field offices have provided interim guidance on some aspects of the Hanford CBDPP in the form of contract direction. Please refer to company specific implementing programs and DOE field offices for more specific information. Other regulatory requirements (e.g., EPA, State) may apply, depending on the nature of the work and the potential for contaminating the environment (i.e., air, water, soil).

Exposure Limits and Controls:

<table>
<thead>
<tr>
<th>Exposure Limits (TWA-8hr)</th>
<th>PEL (µg/m³)</th>
<th>AL (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 CFR 850</td>
<td>2 (OSHA)</td>
<td>0.2</td>
</tr>
<tr>
<td>Hanford</td>
<td>2</td>
<td>0.1</td>
</tr>
</tbody>
</table>
BERYLLIUM (page 2)

Removable Surface Contamination Limits

<table>
<thead>
<tr>
<th></th>
<th>Release</th>
<th>Housekeeping</th>
<th>Beryllium Control Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(µg/100 cm²)</td>
<td>(µg/100 cm²)</td>
<td>(µg/100 cm²)</td>
</tr>
<tr>
<td>10 CFR 850</td>
<td>&lt;0.2</td>
<td>3.0</td>
<td>---</td>
</tr>
<tr>
<td>Hanford Wipe</td>
<td>&lt;0.2</td>
<td>3.0</td>
<td>&gt;0.2</td>
</tr>
<tr>
<td>Hanford Bulk</td>
<td>&lt;2 ppm (µg/g)</td>
<td>---</td>
<td>&gt;2 ppm (µg/g)</td>
</tr>
</tbody>
</table>

Forthcoming DOE-0342 Revision 2 Documents (not yet implemented)

- **DOE-0342 Revision 2A**
  - Hanford Site Chronic Beryllium Disease Prevention Program, Rev 2A
- **DOE-0342-001**
  - Hanford Site Beryllium Work Permit (BWP) and Hazard Assessment Procedure
- **DOE-0342-002**
  - Hanford Site Assessment & Characterization/Verification of Buildings Procedure
- **DOE-0342-003**
  - Hanford Site Beryllium Postings and Labeling Requirements Procedure
- **DOE-0342-004**
  - Hanford Site Assessment & Characterization/Verification of Structures/Conex Box
- **DOE-0342-005**
  - Hanford Site Evaluation of Electrical Equipment for Beryllium Procedure

Regulations driven by **10 CFR 851**.*

10 CFR 850
29 CFR 1910 Subpart Z, Toxic and Hazardous Substances
29 CFR 1910.1000, Air contaminants

*Some other WAC and EPA codes may apply
Summary:
OSHA has chemical safety standards that are specific to a particular industry or process. A summary of the requirements follows:

- **29 CFR 1910.119 - Process safety management of highly hazardous chemicals.**
  This standard contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire or explosion hazards.

- **29 CFR 1910.120 - Hazardous waste operations and emergency response.** This standard covers:
  - Clean-up operations required by a governmental body that are conducted at uncontrolled hazardous waste sites, and initial investigations of government identified sites that are conducted before the presence or absence of hazardous substances has been ascertained;
  - Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA);
  - Voluntary clean-up operations at sites recognized by Federal, State, local or other governmental bodies as uncontrolled hazardous waste sites;
  - Operations involving hazardous waste that are conducted at treatment, storage, disposal facilities, and
  - Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

- **29 CFR 1910.1200 - Hazard Communication.**
  The requirements of this standard are intended to be consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Requirements include:
  - Written hazard communication program,
  - Lists of hazardous chemicals present,
  - Labeling for containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces,
  - Safety data sheets for employees and downstream employers, and
  - Training programs regarding chemical hazards and protective measures.

- **29 CFR 1910.1450 - Occupational exposure to hazardous chemicals in laboratories.**
  This standard applies to all employers engaged in the laboratory use of hazardous chemicals. Laboratory use of hazardous chemicals means handling or use of such chemicals in which:
  - Chemical manipulations are carried out on a "laboratory scale";
  - Multiple chemical procedures or chemicals are used;
  - The procedures involved are not part of a production process, nor in any way simulate a production process; and
  - Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Regulations driven by 10 CFR 851:
- 29 CFR 1910.120, Hazardous waste operations and emergency response
- 29 CFR 1910.1450, Occupational exposure to hazardous chemicals in laboratories
CONFINED SPACES

Summary:
OSHA’S Confined Space Standard describes the safety and health requirements to safely enter confined spaces. Confined spaces may require a permit to enter. OSHA defines a “confined space” as any space:

 ✓ Large enough to enter
 ✓ That has limited or restricted means for entry or exit
 ✓ That is not designed for continuous employee occupancy

A “permit-required confined space” is a space that has one or more of the following:

 ✓ Potential to contain a hazardous atmosphere
 ✓ Contains a material that has the potential for engulfing an entrant
 ✓ An internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls
 ✓ Contains any other OSHA-defined serious safety or health hazards

OSHA worker protection program requirements at the Hanford Site are found in the site Confined Space Entry Procedure, DOE-0360. The procedure describes how confined space entries are safely managed on the site. The procedure describes:

 ✓ Training requirements
 ✓ Atmospheric testing requirements
 ✓ Roles and responsibilities
 ✓ Written permit requirements
 ✓ Recordkeeping requirements
 ✓ Confined space inventory
 ✓ Confined space warning sign requirements
 ✓ Pre-planning and rescue planning
 ✓ Requirements for periodic program reviews

Regulations driven by 10 CFR 851:

29 CFR 1910.146
ELECTRICAL SAFETY

Summary:
OSHA requires the establishment of an electrical safety program to protect employees from electrical hazards in the work place. Key elements of the OSHA program are:

- Employee technical and safety training
- Installation and maintenance of approved electrical equipment and related devices

In general, employees whose work requires exposure to energized electrical conductors must be adequately trained to recognize specific electrical hazards and be qualified to implement the methods and procedures that prevent shock, arc flash, and explosion.

Hanford Prime Contractors implement OSHA and National Fire Protection Association 70E / Electrical Safety in the Workplace, by complying with DOE-0359, Hanford Site Electrical Safety Program.

The HSESP describes the protocol for:

- Electrical Safety Training and Qualifications Requirements for: Non-Electrical Workers, Qualified Instrument Specialists, Qualified Electrical Worker, Qualified Electrical Supervisors, National Electrical Code Inspectors, Proximity Spotters
- Electrical Equipment Listing, Labeling, and Approval Requirements
- Electrical Safe Work Practices
- Ground Fault Circuit Interrupters (GFCI)
- Assured Equipment Grounding
- Cord and Plug Connected Equipment and Flexible Cord Sets for Maintenance, Construction, and Demolition Activities
- Use of Extension Cords and Multiple Outlet Power Strips

The primary electrical hazard control is to de-energize conductors and circuit parts to the extent possible and put into an electrically safe work condition in accordance with DOE-0336, Hanford Site Lockout/Tag-out Procedure.

All other electrical work (except when the employer can demonstrate that the task presents a greater hazard or is infeasible) requires an Energized Electrical Work Permit (EEWP).

EEWP work can include but is not limited to: Working within the Limited Approach and Arc Flash protection Boundaries.

Regulations driven by 10 CFR 851:
29 CFR 1910.146, Permit required confined spaces
29 CFR 1910 Subpart S, Electrical
29 CFR 1926 Subpart K, Electrical
NFPA 70E “Electrical Safety in the Workplace”
FALL PROTECTION

Summary:
OSHA requires employers to prevent falls by providing fall protection whenever an employee has the potential to fall 4 feet or more. When work is considered “construction,” fall protection is required when the potential fall is 6 feet or more.

Fall Protection is designed to meet the specific fall hazard an employee may encounter. Protection is one or a combination of the following:

✓ Guardrails
✓ Handrails
✓ Personal Fall Arrest Systems
✓ Personal Fall Restraint Systems
✓ Warning Lines
✓ Safety Monitoring Systems

DOE-0346, Hanford Site Fall Protection Program is the requirements document that describes, in detail, the use of fall protection methods for specific work situations. They include but are not limited to:

✓ Leading Edge Work
✓ Working near Excavations
✓ Roofing Work and Roof Access
✓ Aerial Lifts
✓ Crane Suspended Personnel Lift Platforms

Regulations driven by 10 CFR 851:

29 CFR 1926, Subpart M, Fall Protection
FIRE SAFETY

Summary:
OSHA requires employers to maintain a workplace fire safety program. In addition, DOE has adopted National Fire Protection Association (NFPA) 101, Life Safety Code. OSHA requirements focus on employee safety. NFPA 101 focuses on employee safety and property protection. OSHA requires:

- Each occupied building to have two means of egress
- Exit doors must not be blocked or locked
- Exit routes must be kept clear
- Workplace buildings must have extinguishers (NFPA 101 may not require extinguishers when the written emergency response to a fire alarm is immediate evacuation)
- Emergency evacuation plans must be in writing
- Employees expected to use and must be trained in the use of the extinguisher
- Written evacuation plans are required

All current occupied buildings and new construction at the Hanford Site are required to comply with NFPA 101. Buildings within the city of Richland may have to comply with additional city codes. To assure compliance with the NFPA 101 and OSHA requirements:

- Periodic inspections are conducted to verify compliance
- Scheduled preventive maintenance is performed on fire alarms, fire suppression systems, exit doors
- Code deficiencies are immediately corrected or entered into Corrective Action Management

Regulations driven by 10 CFR 851:

29 CFR 1910 Subpart L - Fire Protection
HAZARDOUS ENERGY CONTROL

Summary:
OSHA requires a hazardous energy control program while employees are servicing and/or conducting maintenance on machines and equipment. The program is required, if:

The unexpected startup of machines or equipment, or release of stored energy, could harm employees.

The Energy Control Program must include an Energy Control Procedure that describes:

- Steps for shutting down, isolating, blocking, and securing to control hazardous energy
- Placement, removal, and transfer of lockout devices
- Testing a machine or equipment to determine and verify the effectiveness of lockout methods
- Periodic Inspections criteria
- Training and communication

DOE-0336, Hanford Site Lockout/Tag-Out Procedure, is the requirements document for Hanford Site Contractors. The procedure describes the methods for Hanford contractors to meet the OSHA Hazardous Energy Control requirements. Two energy control methods (the eight-criteria and Tag-out Authorization Form) for assuring equipment is de-energized are described below:

1. The eight-criteria process (utilized for the majority of lockouts) allows Authorized Workers to lock out energy when certain criteria are met without completing a detailed description of the lockout method (TAF).

All eight criteria, below, must be met to use the eight-criteria method:
1. No potential for stored or residual energy
2. There is a single energy source
3. Locking out will completely de-energize the equipment
4. The equipment is isolated from the energy source and locked out
5. A single lockout device will achieve a locked out condition
6. The lockout device is under the exclusive control of the Authorized Worker
7. The work does not create hazards for others
8. There have been no incidents previously when this method has been used

2. A controlling organization lockout/tagout using a TAF clearly and specifically outlines the scope, purpose, authorization, rules, and techniques used to control hazardous energy.

Regulations driven by 10 CFR 851:

29 CFR 1910.147, Control of Hazardous Energy
HEARING CONSERVATION

Summary:
OSHA requires employers to implement a Hearing Conservation Program where workers are exposed at or above the action level (AL) of 85 dBA, which is a time weighted average (TWA) noise level over an 8-hour work shift. This also equates to the occupational exposure limit used by Hanford Contractors required to comply with the more conservative American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV). Hanford Contractors have company-specific programs for this hazard.

Exposure Limits and Controls:

<table>
<thead>
<tr>
<th>ACGIH TLV TWA -8 hr</th>
<th>OSHA AL TWA-8 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 dBA</td>
<td>85 dBA</td>
</tr>
</tbody>
</table>

If noise exposures are greater than the AL, the OSHA requirements for employer Hearing Conservation Programs include:

- Noise level measurements
- Annual hearing exams
- Hearing protection
- Training
- Hearing protector evaluations

These requirements are applicable unless changes to tools, equipment, and schedules are made so that they are less noisy and worker exposure to noise is less than the 85 dBA.

Regulations driven by 10 CFR 851:

- 29 CFR 1910.95, Occupational noise exposure
- 29 CFR 1926.52, Occupational noise exposure

ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (2005)
HEXAVALENT CHROMIUM

Summary:
OSHA’s Chromium (VI) Standard covers chromium (VI) in all forms and compounds except exposure during pesticide application and use of Portland cement. The standard doesn’t apply if the employer has objective data demonstrating the material, process, or activity cannot release dusts, fumes, or mists of chromium (VI) in concentrations at or above 0.5 µg/m³ as an 8-hour time-weighted average (TWA) under any expected conditions of use. The standard establishes maximum limits of exposure to chromium (VI) for all workers covered, including a permissible exposure limit (PEL) and action level (AL).

Hanford Contractors have company-specific programs for this hazard. Other regulatory requirements (e.g., EPA, State) may apply depending on the nature of the work and the potential for contaminating the environment (i.e., air, water, soil).

Exposure Limits and Controls:

| General | • Exposure determination (Monitoring or Performance-oriented), Records  
• Training & Hazard communication  
• Housekeeping |
| ≥ OSHA AL 2.5 µg/m³ | • Periodic monitoring – ≤ 6 months  
• Medical surveillance |
| ≥ OSHA PEL 5 µg/m³ | • Periodic monitoring – ≤ 3 months  
• Regulated areas (general industry activities only)  
• Engineering, work practices, respirators |
| Skin/Eye | • PPE  
• Hygiene areas and practices |

Regulations driven by 10 CFR 851:*  
29 CFR 1910.1026, Chromium (VI)  
29 CFR 1926.1126, Chromium (VI)

*Some other WAC and EPA codes may apply
HOISTING AND RIGGING

Summary:

OSHA requires employers who use hoisting and rigging equipment to maintain, service, and operate that equipment compliant with consensus operational and maintenance safety practices. These practices include, but are not limited to:

- Pre-operational inspections of equipment prior to placing in service
- Daily pre-operational inspections
- Short-term and Long-term comprehensive inspections
- Equipment specific operator training to assure operators are qualified
- Recordkeeping of Long term and Short term periodic inspections and maintenance records
- Controlling pre-lift equipment conditions such as adequate load capacity, distance from power lines, wire rope status, boom clearance boundaries, properly securing loads, and properly blocking and leveling mobile cranes

OSHA addresses rigging equipment such as wire rope and slings and requires employers provide hardware that is appropriate for the lifting application.

Hanford Site Contractors comply with requirements described in the Hanford Site Hoisting and Rigging Manual, DOE- RL-92-36. This manual is comprehensive and includes procedures and specifications for all hoisting and rigging equipment and employees including:

- Personnel qualifications and training requirements
- Crane hooks
- Forklift Trucks
- Shop Cranes
- Wire Rope
- Slings
- Rigging hardware
- Below-the-Hook Lifting Devices
- Hoists, Jib Cranes, and Monorail Systems
- Overhead and Gantry Cranes
- Mobile Cranes
- Personnel Lifting
- A-Frames and Trolleys
- Critical Lifting

Regulations driven by 10 CFR 851:

- 29CFR1910.179 (Overhead and gantry cranes)
- 29CFR1910.180 (Crawler locomotive & truck cranes)
- 29CFR1910.184 (Slings)
- 29CFR1926.251 (Welding)
- 29CFR1926 Subpart N
- 29CFR1910.178 (Powered Industrial Trucks)
LEAD

Summary:
OSHA’s Lead Standard covers lead in a variety of forms, including metallic lead, all inorganic lead compounds, and organic lead soaps. The standard establishes maximum limits of exposure to lead for all workers covered, including a permissible exposure limit (PEL) and action level (AL).

The standard requires a worker protection program for employees exposed to lead above the PEL that should include:

- Hazard determination, including exposure assessment
- Medical surveillance and provisions for medical removal
- Job-specific compliance programs
- Engineering and work practice controls
- Respiratory protection
- Protective clothing and equipment
- Housekeeping
- Hygiene facilities and practices
- Signs
- Employee information and training
- Recordkeeping

Hanford Contractors have company-specific programs for this hazard. Other regulatory requirements (e.g., EPA, State) may apply depending on the nature of the work and the potential for contaminating the environment (i.e., air, water, soil).

Exposure Limits and Controls:

<table>
<thead>
<tr>
<th>OSHA PEL-8 hr</th>
<th>OSHA AL</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 µg/m³</td>
<td>30 µg/m³</td>
</tr>
</tbody>
</table>

Until the employer performs an exposure assessment and documents that employees are not exposed above the PEL, OSHA requires some degree of interim protection for employees. This means providing respiratory protection, protective work clothing and equipment, hygiene facilities, biological monitoring, and training—as specified by the standards—for certain tasks prone to produce high exposure.

Employers must make available, at no cost to the employee, initial medical surveillance for employees exposed to lead on the job at or above the action level on any one day per year. This initial medical surveillance consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin (ZPP) levels. In addition, a medical surveillance program with biological monitoring must be made available to any employee exposed at or above the action level for more than 30 days in any consecutive 12 months.

If an employee’s airborne lead level is at or above the AL for more than 30 days in any consecutive 12 months, the employer must make biological monitoring available on a prescribed schedule of greater frequency.
If the initial assessment indicates that no employee is exposed above the AL, the employer may discontinue monitoring. Further exposure testing is not required unless there is a change in processes or controls that may result in additional employees being exposed to lead at or above the AL, or may result in employees already exposed at or above the AL being exposed above the PEL.

If lead exposures are expected to meet or exceed the AL, then training and medical surveillance are required for Lead Workers. Exposure controls (engineering, administrative, and/or PPE) would be put in place if exposures are expected to meet or exceed the PEL. Examples of controls include: HEPA vacuums, wet methods, distancing employees from abrasive blasting operations, chemical removal instead of hand scraping, replacement of lead-based painted components, brushing/rolling paint instead of spraying, substituting other coatings for lead-based coatings, mobile hydraulic shears for cutting instead of torch cutting, encapsulating lead surfaces, respirators, gloves, coveralls and hygiene.

**Regulations driven by 10 CFR 851:**

29 CFR 1910.1025, Lead  
29 CFR 1926.62, Lead

*Some other WAC and EPA codes may apply*
PORTABLE HAND TOOLS

Summary:
Portable hand tools can be hazardous when used improperly. OSHA requires precautions be taken when using portable hand tools.

Each employer is responsible for the safe condition of tools and equipment used by employees. These include, but are not limited to:

- Non-powered hand tools
- Powered hand tools
- Powered abrasive wheels
- Powder actuated tools
- Hydraulic power tools
- Jacks
- Compressed air
- Wrenches, hammers, screw drivers, chisels, etc.

Hanford Contractors have company-specific programs to address hand and power tool requirements including:

- Tool inspection
- Tool storage
- Personal protection (safety glasses, hearing protection, shoes, and apparel)
- Tool guarding

The following general precautions should be observed by power tool users:

- Never carry a tool by the cord or hose
- Never yank the cord or the hose do disconnect it from the receptacle
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.
- All observers should be kept at a safe distance away from the work area
- Secure work with clamps or a vise, freeing both hands to operate the tool
- Avoid accidental starting
- Tools should be maintained with care
- Follow instructions in the user’s manual
- Maintain good footing and good balance
- Wear proper apparel (no loose clothing, jewelry)
- Remove damaged tools from service and tag the tool appropriately
- Never remove or bypass a guard
- Store electrically-powered tools in a dry place

Regulations driven by 10 CFR 851:

29 CFR 1926 Subpart I, Tools – Hand and Power
RADIATION

Summary:
In 10 CFR 835, DOE establishes radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities. Each contractor develops a Radiation Protection Program (RPP) for their scope of work. The RPP contains all applicable requirements that form the basis for radiation protection controlling documents and procedures for a contractor’s scope. The contractor’s RPP contains information under the following topics for controlling contamination/radiation levels and for monitoring employees exposed to radiation:

✓ Makeup of the Radiological Control organization
✓ Dose limits to workers, the public, and embryo/fetus
✓ Contamination control
✓ Posting of areas
✓ Entry and exit requirements
✓ Radiological work controls
✓ Radioactive material identification, storage, and control
✓ Release and transportation of radioactive material
✓ Radioactive source control
✓ External and internal dosimetry
✓ Respiratory protection
✓ Monitoring and surveys
✓ Instrumentation and calibration
✓ General employee, radiation worker, and RCT training
✓ Radiological records

Exposure Limits and Controls:

A radiation dose limit to a worker of 5000 mrem per year is established in 10 CFR 835. Hanford contractors further control dose through an established maximum Administrative Control Limit (ACL) of 2000 mrem. However, each worker starts at a limit of 500 mrem and raising this limit requires sequentially higher approvals.

<table>
<thead>
<tr>
<th>Administrative Control Levels</th>
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</thead>
<tbody>
<tr>
<td>Annual Dose in mrem</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TED*</th>
<th>Skin and Extremity</th>
<th>Lens of Eye</th>
<th>Any Organ</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>15,000</td>
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</tr>
<tr>
<td>2,000</td>
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</tbody>
</table>

*TED = Total Effective Dose
Workers are protected from exposure to radiation by first characterizing the type and amount of radioactive material by facility knowledge, sampling, and direct measurements. A radiological area may then be established due to loose surface contamination, radioactivity, or both. The area is controlled by the use of postings and physical barriers, and both the perimeter and the area itself are monitored for changing conditions through routine surveys performed by Radiological Control Technicians. Personnel who access areas with potential loose contamination wear personal protective equipment based on the anticipated levels, and are surveyed upon exit using handheld instruments or personnel contamination monitors. Workers who enter radiological areas are also required to verify their qualifications to work in the area by using the Access Control Entry System (ACES) to verify appropriate monitoring and training.

Employees who are exposed to radiation are monitored to determine the amount of dose received. Monitoring of external radiation is accomplished by wearing a dosimeter, and intakes of radioactive material are assessed using bioassay. A dosimeter or bioassay is required if an employee may receive 100 mrem in one year from external or internal sources, respectively. A bioassay can be a direct measurement of radioactivity in the body or it can be an analysis of excreta/tissue samples that are evaluated at a laboratory. Radiation doses are summed each calendar year and reported to monitored individuals. Personal dose records are maintained for at least 75 years.

**Regulations:**

10 CFR 835
RESPIRATORY PROTECTION

Summary:
The OSHA Respiratory Protection Standard establishes the permissible practices and program requirements. The Hanford Site Respiratory Protection Program (HSRPP), DOE-0352 provides the comprehensive process for all aspects of respirator use at Hanford. Contractors are required to implement the HSRPP DOE-0352. Contractors have company-specific implementing programs describing their process.

The OSHA Standard and the HSRPP address the following summarized requirements:

✓ Respirator selection
✓ Medical evaluations
✓ Fit testing
✓ Proper use for routine and emergency situations
✓ Cleaning, storing, inspection and maintenance
✓ Breathing air quality
✓ Training
✓ Voluntary respirator use
✓ Evaluation of program effectiveness

Regulations driven by 10 CFR 851:

29 CFR 1910.134, Respiratory Protection
SCAFFOLDING

Summary:
Scaffold safety is directly addressed in OSHA standards for general industry, shipyards, marine environments and long-shoring. The standards give specific requirements for:

✓ Load maximums
✓ Construction use
✓ When scaffolds are required
✓ Bracing
✓ Planking
✓ Guardrails
✓ Footings
✓ Safe access and egress
✓ Scaffolds greater than 60 feet in height shall be designed by an engineer
✓ Pre-use inspections
✓ Erector and user training

Hanford site contractors maintain individual procedures for implementing OSHA Scaffolding requirements. Sub-contractors may be required to meet site contractor procedures or an equivalent program. Site Contractor procedures describe, in detail, how OSHA requirements are met.

Scaffold procedures describe:

✓ Training for supervisors, crew leaders, and scaffold users (by a Qualified Person)
✓ Competent person inspection requirements
✓ Correct and safe work practices while on scaffolding
✓ Adequate bases for scaffolds, (base plates, adequate sills), planking, and guardrails
✓ Scaffold inspection tagging requirements
✓ Use of manual lifting devices or other specialized scaffolding mechanisms

Site Contractor Scaffolding procedures set forth common-sense guidelines for safely erecting, inspecting, and dismantling scaffold equipment.

Regulations driven by 10 CFR 851:

29 CFR 1926 Subpart L - Scaffolds
29 CFR 1910.28, Safety requirements for scaffolding
29 CFR 1926.451, General requirements
29 CFR 1926.454, Training requirements
SOLVENTS AND ORGANIC COMPOUNDS

Summary:
Many materials used at Hanford contain solvents. Some of the hazardous waste cleanup work at Hanford involves removing solvent contamination from the soil and ground water from historical spills. Hanford Contractors have company specific programs for this hazard. Examples of solvents, organic compounds and mixtures of include:

<table>
<thead>
<tr>
<th>Alcohols</th>
<th>Methylene chloride</th>
<th>Toluene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Lacquer</td>
<td>Trichloroethylene</td>
</tr>
<tr>
<td>Gasoline</td>
<td>Mineral spirits</td>
<td>Turpentine</td>
</tr>
<tr>
<td>Kerosene</td>
<td>Xylene</td>
<td>Varnish</td>
</tr>
<tr>
<td>Methyl ethyl ketone</td>
<td>Petroleum distillates</td>
<td>Carbon tetrachloride</td>
</tr>
<tr>
<td>Styrene</td>
<td>Isocyanates</td>
<td></td>
</tr>
</tbody>
</table>

Health Effects
The typical health hazards associated with exposure to solvents include damage, including some cancers, to the following systems/organs:

<table>
<thead>
<tr>
<th>Reproductive system</th>
<th>Liver</th>
<th>Kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous system</td>
<td>Respiratory system</td>
<td>Skin</td>
</tr>
</tbody>
</table>

Exposure Limits and Control
There are exposure limits established for over 100 solvents/organic compounds including those most commonly used. The limits vary with each solvent. If the exposure limit is exceeded, control measures like ventilation must be used to reduce harmful airborne exposures. When these controls are impossible or inadequate, respirators may be required. Controls for specific compounds, hazardous waste and laboratory operations are specified in specific OSHA standards. Some solvent exposures will require medical surveillance, particularly carcinogens. Hazard communication on the hazard recognition, labels, exposure limit, controls, and spill response is required for working with solvents. Sometimes more extensive training is required.
Regulations driven by *10 CFR 851:*

29 CFR 1910.120 HAZWOPER
29 CFR 1910 Subpart Z – Toxic and Hazardous Substances
29 CFR 1910.1000 Air contaminants
29 CFR 1910.1002 Coal tar pitch volatiles
29 CFR 1910.1003 13 Carcinogens
29 CFR 1910.1004 alpha-Naphthylamine
29 CFR 1910.1006 Methyl chloromethyl ether
29 CFR 1910.1010 Benzidine
29 CFR 1910.1011 4-Aminodiphenyl
29 CFR 1910.1012 Ethyleneimine
29 CFR 1910.1013 beta-Propiolactone
29 CFR 1910.1014 2-Acetylanilinofluorene
29 CFR 1910.1015 4-Dimethylaminoazobenzene
29 CFR 1910.1016 N-Nitrosodimethylamine
29 CFR 1910.1017 Vinyl chloride
29 CFR 1910.1028 Benzene
29 CFR 1910.1044 1,2-dibromo-3-chloropropane
29 CFR 1910.1045 Acrylonitrile
29 CFR 1910.1047 Ethylene oxide
29 CFR 1910.1048 Formaldehyde
29 CFR 1910.1050 Methyleneedianiline
29 CFR 1910.1051 1,3-Butadiene
29 CFR 1910.1052 Methylene Chloride
29 CFR 1910.1450 Occupational exposure to hazardous chemicals in laboratories

ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (2005)

*Some other WAC and EPA codes may apply. Equivalent OSHA Construction Standards may apply, but are not listed due to space considerations.
STOP WORK

The purpose of the Hanford Stop Work Procedure, DOE-0343, is to ensure that all employees are given the responsibility and authority to stop work when employees believe that a situation exists that places them, their coworker(s), contracted personnel, or the public at risk or in danger; could adversely affect the safe operation or cause damage to the facility; or result in a release of radiological or chemical effluents to the environment above regulatory requirements or approvals; and provides a method to resolve the issue. Maintaining a diligent questioning attitude is vital to safe execution of work-scope and is a cornerstone to effective Conduct of Operations and Integrated Safety Management.

DOE-0343, Rev 2, Stop Work
TEMPERATURE EXTREMES

Summary:
Hanford contractors use the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for evaluating heat and cold exposure hazards. Hanford Contractors have company specific programs for this hazard.

Heat: Health Effects

Heat strain usually includes increased core body temperature, increased heart rate or sweating. Heat exhaustion and heat stroke are severe health effects from over exposure to heat.

Heat exhaustion is recognized by profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and clammy with sweat. Body temperature is normal or subnormal, and nausea, vomiting, and unconsciousness may occur.

Heat stroke is a life-threatening heat disorder characterized by diminished or absent sweating. The skin is hot, dry, and flushed. Increased core body temperature may lead to delirium, convulsions, coma, and even death.

Heat: Exposure Limits and Controls

For heat, TLV exposure limits incorporate work exertion level, non-cooling clothing/equipment, and wet bulb globe thermometer (WBGT) temperatures. Exposure controls include engineering (air conditioning the work area), administrative (work/rest regimens, changing to night shifts), and cooling PPE (light weight coveralls, brimmed hats, cooling devices). There are some work conditions that may require employees to be medically evaluated to work in a hot environment. Heat stress awareness and training for work in hot environments is an important part of heat stress control at Hanford.

Cold: Health Effects

Experts have found that fatal exposures to cold (e.g., lowered deep body temperature) have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water.

Frostbite can affect extremities (e.g., ears, nose, fingers, toes). The signs for frostbite include whitening of the skin surface. Numbness, tingling, itching, or a burning sensation can also indicate other cold temperature disorders.

Hypothermia is when the body has a dangerously low core temperature. Uncontrollable shivering decreased mental coherence, slurred speech, memory lapses, drowsiness, exhaustion, slow or irregular heartbeat, weak pulse, and blood pressure changes are signs of hypothermia.
TEMPERATURE EXTREMES (page 2)

**Cold: Exposure Limits and Controls**

For cold, TLVs also incorporate environmental factors and clothing. Environmental factors affecting the severity of cold exposure include temperature, wetness, and wind chill. Additional factors include length of exposure, type of clothing, amount of exposure skin, and body movement. Because of Hanford’s climatic conditions and the nature of the work activities, the primary focus on site is the prevention of cold injury to body extremities, e.g., frostbite. Working in a buddy system and/or having communication devices aid in avoiding these types of injuries. Hanford workers are not routinely exposed to extreme cold temperatures (less than 10.4 F) that would require medical surveillance and training.

**Regulations driven by 10 CFR 851:**

ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (2005)
VEHICLE SAFETY

Summary:
Washington State traffic and vehicle codes are applicable on the Hanford Site. These include traffic laws, rules, standards, and best practices for cities and counties, see Revised Code of Washington (RCW), Motor Vehicles, 46.08.030 (as adopted by Benton County through Ordinance).

All signage, signaling, and flagging must comply with the Manual on Uniform Traffic Control Devices.

State Law requires:

✓ Mandatory seat belt use in all vehicles
✓ Strict enforcement of speed limits, stop signs, and detour requirements
✓ Possession of a valid driver’s license
✓ Drivers do not use cell phones
✓ Adherence to parking signage that meets Americans with Disabilities Act requirements
✓ Controlled substances and alcohol use testing apply to every driver

Enforcement:

✓ The Benton County Sheriff’s Department patrols Hanford roads and parking lots enforcing posted speed limit signs and parking requirements
✓ The Sheriff’s Department can issue citations
✓ Benton County fines and disciplinary actions apply

Department of Transportation (DOT) requirements apply for all commercial motor vehicle (CMV) drivers (teamsters).

Commercial drivers on the Hanford site must:

✓ Must have valid driver’s license and a Commercial Driver’s License (CDL)
✓ Be 21 years of age
✓ Read and speak the English language
✓ Be physically qualified to drive a commercial motor vehicle
✓ Maintain his/her qualifications
✓ Be trained on the vehicle he/she operates and the requirements associated with the load (e.g., Hazardous Substances)

Hanford contractors use GSA vehicles which are on a required preventive maintenance schedule. Regular oil changes, brake and light inspection and replacement, when needed, are fundamental parts of this program.

Regulations driven by 10 CFR 851:

Revised Code of Washington (RCW), Motor Vehicles, 46.08.030
(as adopted by Benton County through Ordinance)
WALKING/WORKING SURFACES

Summary:
OSHA requires employers provide walking/working surfaces that meet specified engineering and administrative control requirements. Identified below are the walking/working surfaces OSHA addresses in 29 CFR 1910:

- Protection for floor openings
- Housekeeping
- Protection for wall openings and holes
- Stairway railings and guards
- Railings, toe boards, and cover specifications
- Fixed stairs
- Portable wood ladders
- Portable metal ladders
- General requirements for scaffolds
- Manually propelled mobile ladder stands and scaffolds
- Fixed ladders
- Other walking working surfaces

Hanford Contractors have company specific programs that implement OSHA’s Walking/Working Surfaces requirements.

DOE-0346, Hanford Site Fall Protection Program addresses potential fall hazards described in the standard. These include:

- Guarding of floor openings
- Protection for wall openings and holes
- Protection from open-sided floors
- Stairway railings and guards
- Walkway Railings required at a height of 4 feet
- Aerial lift railing requirements
- Personal fall protection equipment requirements when guard rails are not feasible

Other walking/working surface requirements are addressed in Hanford Contractor procedures. These include:

- Portable ladders
- Requirements for scaffolds
- Fixed ladders
- Housekeeping

Use of ladders, scaffold erection, use and inspection, in contractor procedures, require users be trained to specific performance requirements. Competency must be demonstrated, for example, before an individual can erect a scaffold for use on a worksite.

Use of portable ladders, by most site contractors, requires the completion of a ladder-user safety course. Users are trained to inspect ladders for deficiencies, how to use a ladder safely, and how to avoid accidents associated with ladder misuse.

Regulations driven by 10 CFR 851:
29 CFR 1910 Subpart D, Walking Working Surfaces