THE NATION'S URANIUM PROCESSING FACILITY

UPF JOB HAZARD ANALYSIS

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JHA NO.:	**JHA-00719**	**REV:**	**2**	**ISSUE DATE:**	**11-22-2024**
JHA TITLE:	**Fire Prevention, Protection, Hot Work and Welding**	**WORK PACKAGE NUMBER:**	**N/A**	**SPECIFIC LOCATION:**	**N/A**

Activity	Sub-Activity	Hazard	Control
Grinding Activities	Grinding Activities on Uncoated Metal	Flying Particles (Debris) Grinding Wheel Failure Loss of Tool Control - Laceration (Grinding Activities) Burn Fire (Hot Work)	· Reference ML-SH-801768-A002, UPF Eye and Face Protection List.
			· Ensure the grinding wheel is rated for higher revolutions per minute (RPM) than the grinder. Ensure the guard is on the grinder.
			· Use the tool handle(s) to maneuver the grinder
			· Hand-held grinders shall be equipped with a constant pressure switch
			· Wear a shirt, jacket (or equivalent) made from heavier materials (e.g., heavy cotton, denim) that overlap footwear to prevent spatter from entering
			· Wear pants/trousers made from heavier materials (e.g., heavy cotton, denim) that overlap footwear to prevent spatter from entering
			· Wear clothing that is free from pockets, hoods, or cuffs that can trap sparks or slag. Keep sleeves and collars buttoned
			· Ensure the material being cut is secured via approved methods (i.e., bench vise, c-clamp)
			NOTE: *Never hold the material that is being cut!*
			NOTE: *Pockets that are covered or equipped with closeable flaps are acceptable. If not in a Designated Hot Work Area, contact the Permit Authorizing Individual (PAI) for a Hot Work Permit and follow the permit requirements.*
Fire Prevention and Protection	Fire Occurrence	Fire	In the event of a fire, personnel are primarily responsible for evacuating themselves and others safely from the fire area. The discoverer of the fire shall perform or direct the following three immediate actions:
			· **Step 1 –** Yell "FIRE" to notify those in the immediate vicinity.
			Step 2 – Notify the Y-12 Operations Center (OC) by:
			o Activating a fire alarm (pull box), if available
			o Calling 911 from a Y-12 landline
			o Calling Y-12 OC at (865) 574-7172 from a cell phone

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			o Contacting the OC via Channel 1 from a Project radio
			o Contacting the supervisor/superintendent and providing any information regarding the fire and its location (to be forwarded to the Y-12 OC)
			NOTE: *Use the phonetic alphabet when calling the OC to avoid confusion identifying the building location.*
			· **Step 3 –** Only after reporting the fire, personnel may voluntarily attempt to fight a small, early-stage fire using an available portable fire extinguisher. This voluntary action should be taken only if personnel believe it is within their capability to safely extinguish or contain the fire, a safe escape route is readily available, and there is no immediate danger.
Fire Prevention and Protection	Ignition Hazards	Fire	· INSTALL electrical wiring and equipment for light, heat, or power purposes in accordance with UPF-MANUAL-CM-001, *Uranium Processing Facility Construction Electrical Safety Manual*
			· DO NOT SMOKE unless in a designated smoking area in accordance with UPFPOLICY- CM-004, *UPF Smoking/Tobacco Use Policy*
			· LOCATE exhausts of internal combustion engine-powered equipment away from combustible materials
Fire Prevention and Protection	Construction Material and Equipment Staging	Fire	It SHALL be permissible to stage incidental piece parts contained in cardboard cartons when stored in closable metal cabinets (i.e., clam shell cabinets) or when properly protected and covered by project-approved fire blanket or equipment.
			WHEN equipment to be installed is staged in unprotected structures under construction, protect the associated Combustible construction and packing materials by covering it with a project-approved fire blankets or equivalent.
			To the extent possible, materials used for temporary construction purposes inside of buildings/structures shall be of the Fire-resistive type.
			MAINTAIN at least a 36-inch clearance between the top level of the stored material and the sprinkler deflectors.
			DO NOT STORE material within 36 inches of a door opening.
			MAINTAIN clearance around lights and heating units to prevent ignition of combustible materials

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Fire Prevention and Protection	Waste Disposal	Fire	· REMOVE accumulations of combustible waste material, dust, and debris at the end of each work shift or more frequently (as necessary)
			· DISPOSE of materials susceptible to spontaneous ignition (e.g., oily rags) in a listed disposal container
			· Trash chutes shall be constructed of noncombustible materials or fire retardant, and plans must be approved by the CAHJ prior to use
Fire Prevention and Protection	Scaffolding, Shoring, and Forms	Fire	ENSURE the following requirements for scaffolding, shoring, and forms are met:
			· PREVENT the accumulations of unnecessary combustible scaffold or form lumber
			· BRING combustible forms or lumber into a structure only when needed
			· REMOVE combustible forms or lumber from the structure as soon as stripping is completed
Fire Prevention and Protection	Temporary Buildings	Fire	· DO NOT ERECT a temporary building within a building under construction unless approved by the BNI FPE
			· DO NOT erect or place a temporary building within the minimum separation distances required in Table 1 from a building under construction or other permanent construction support structures, unless approved in advance by the BNI FPE.
Fire Prevention and Protection	Temporary Enclosures	Fire	· ENSURE only non-combustible panels, flame-resistant tarpaulins, or approved materials of equivalent fire-retardant characteristics are used for temporary enclosures
			· EQUIP each temporary enclosure with a fire extinguisher
Fire Prevention and Protection	Yard Storage	Fire	ENSURE yard storage meets the following criteria:
			· PILE combustible materials with due regard to the stability of the piles, but no higher than 20 feet
			· KEEP the storage areas free from accumulation of unnecessary combustible materials, keep weeds and grass down, and provide periodic cleanup of the entire area
			· DO NOT STORE combustible material outdoors within 30 feet of a building or structure
			· PROVIDE portable fire extinguishing equipment suitable for the fire hazard involved at convenient, conspicuously accessible locations in the yard area

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Activity	Sub-Activity	Hazard	Control
Fire Prevention and Protection	Use of Flammable and Combustible Liquids	Fire	USE only project-approved storage cabinets, containers and Portable Tanks for storage and handling of Flammable and Combustible liquids. USE only Approved safety cans or Department of Transportation-Approved containers for the handling and use of Flammable Liquids in quantities of five gallons or less. The only exception to this requirement is for Flammable liquid materials that are thick and highly viscous (extremely hard to pour), which may be used and handled in original containers. DO NOT STAGE Flammable or Combustible liquids in areas used for exits, stairways, or areas normally used for the safe passage of people or within 35 feet of an exit.
Fire Prevention and Protection	Storage of Flammable and Combustible Liquids	Fire	Designated Flammable and Combustible liquid storage areas (bulk storage) outside of unprotected buildings SHALL be Approved by the BNI FPE. No Flammable or Combustible liquids may be stored inside unprotected buildings. PROVIDE only Approved metal storage cabinets that meet the requirements of NFPA 30, Flammable and Combustible Liquids Code, 2012 Edition. LABEL cabinets with conspicuous lettering “Flammable—Keep Fire Away.” LABEL portable bulk tanks and containers with the applicable NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response, placard. Hot Work or open flames SHALL NOT be allowed in Approved Flammable and Combustible liquid storage areas. KEEP Approved Flammable and Combustible liquid storage areas free from weeds, debris, and Combustible materials not necessary to the storage.

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Activity	Sub-Activity	Hazard	Control
Fire Prevention and Protection	Handling at the Point of Final Use	Fire	Class I and Class II liquids shall be kept in Approved safety containers. Means shall be provided to dispose of leakage and spills promptly and safely. Flammable and Combustible liquids shall be handled only where there are no open flames or other sources of ignition within the possible path of vapor travel. Flammable and Combustible liquids shall be kept in closed tanks or containers when not actually in use. Class I liquids (or Class II and Class III liquids that are heated up to or above their flash points) shall be drawn from or transferred into vessels or containers as follows: • From original shipping containers with a capacity of five gallons or less • From project-approved dispensing device (i.e., plunger cans) ENSURE adequate natural or mechanical ventilation is provided in the area of operation. **NOTE**: *Industrial Hygiene ventilation requirements for the protection of personnel are more restrictive than ventilation requirements pertaining to fire protection and prevention (i.e., maintaining concentrations below 25% of the LFL vs. maintaining concentrations below the OELs). Reference the applicable* ***UCN-23352, SDS Evaluation Form*** *for the work controls necessary during the handling of flammable and combustible liquids.*
Fire Prevention and Protection	Refueling	Fire	· ENSURE only approved vehicles are used for refueling activities
			· ENSURE portable fuel cells/tanks comply with NFPA 30 and are UL listed to include the dispensing hose and nozzle. IF fuel cells/tanks are required to be lifted, ENSURE the tank is rated and approved for hoisting
			· SHUT OFF the motors of all equipment being refueled before refueling operations begin. If pumps are used to refuel, THEN ENSURE they are provided with automatic shutoff
			· DO NOT refuel vehicles and/or portable equipment in buildings under construction
			· PROVIDE adequate spill preventing and control means
Fire Prevention and Protection	Use of Temporary Heating Devices	Fire	ENSURE the following requirements for temporary heating devices are met:
			· SUPPLY fresh air in sufficient quantities to maintain the health and safety of workers
			· WHEN fresh air supply is inadequate, THEN PROVIDE mechanical ventilation

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			· INSTALL temporary heating devices to provide 36-inch clearance to all material, unless otherwise specified by the manufacturer
			· ENSURE heaters used in the vicinity of tarpaulins or similar sheet material are located at least 10-feet from the coverings, and the covering is securely fastened to prevent ignition or upsetting the heater as a result of wind or severe weather
			· ENSURE heaters, when in use, are set horizontally level unless otherwise permitted by the manufacturer's markings
			· DO NOT USE solid fuel salamanders or temporary heating equipment using exposed radiant heating wires
			· ENSURE flammable liquid-fired heaters are equipped with a primary safety control to stop the flow of fuel in the event of flame failure barometric or gravity oil feed is not considered a primary safety control
			· ENSURE heaters designed for barometric or gravity oil feed are used only with the integral tanks. USE and MAINTAIN temporary heating equipment in accordance with the manufacturer's instructions
			· ENSURE portable heaters, regardless of fuel source, are equipped with an approved automatic device to shut off the flow of gas to the main burner and pilot, if used, in the event of flame failure
			· ENSURE heaters having inputs above 50,000 Btu per hour are equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electrical ignition system
			· ENSURE fuel supplies for liquefied petroleum gas-fired heaters comply with NFPA 54, *National Fuel Gas Code*, and NFPA 58, *Liquefied Petroleum Gas Code*
			· ENSURE heating devices are secured and immobile during operation
			· Temporary Construction HVAC shall be designed to maintain the temperature in the buildings under construction above freezing until the permanent HVAC systems are installed and commissioned
Safety Watch	Process	Emergency	In the event of an emergency, individuals performing Safety Watch duties are to discontinue the assignment and respond to the emergency as required (e.g., Take Cover, Evacuation).
	Fire Watch	Fire	A worker assigned as a Fire Watch:

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Activity	Sub-Activity	Hazard	Control
Safety Watch		Hot Work	· Must wear an orange vest in accordance with UPF-CP-205, Personal Protective Equipment and Safe Work Apparel
			· Directly observes Hot Work activities to Ensure fire safe conditions, as specified in the Hot Work permit, are maintained. Such observations will continue while Hot Work is in progress or until such a time that the assigned Fire Watch is relieved by another qualified Fire Watch
			· Will remain at the work area for at least 30 minutes after Hot Work activities have stopped to Ensure no smoldering embers or slag exist. Fire Watches will watch for fires in all exposed areas and notify supervision and other workers in the event of a fire
			· The Fire Watch ensures that the Hot Work area is barricaded, if required by the permit, and keeps other personnel from entering the barricaded work area
			· More than one Fire Watch is required if:
			o Combustible materials that could be ignited by the Hot Work operation and that cannot be directly observed by the initial Fire Watch are present (e.g., when welding or cutting over grating surfaces adjacent to floor and wall openings)
			o Fire prevention methods are not sufficient to adequately ensure the prevention of fires. The supervisor responsible for the welding and/or cutting activities then requires additional Fire Watches to guard against fires
			o The Fire Watch will have the authority to stop welding and/or cutting work activities if unsafe conditions develop
			In the event of a fire, the Fire Watch:
			· May attempt to extinguish the fire
			· Notifies and clears out nearby personnel
			· Ensures emergency response has been summoned
			· The Fire Watch shall notify the ESH-R if any fire extinguishers are discharged so they may be refilled and appropriate clean up and disposal of the material can be completed.

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			Upon completion of the job and after it has been determined that no fires or smoldering materials are present, the Fire Watch returns the fire protection equipment to its original location
Hot Work	Establishing Permissible Areas	Fire Improper Use of Tools/Equipment Shock Burn	Ensure the hot work equipment to be used is in satisfactory operating condition. When establishing hot work areas, the welding blanket, screen, and/or curtain that is protecting the combustibles can be located around the combustibles or around the hot work operator. This is not considered a modification to the 35-Foot Rule that required FPE approval. The following must be performed to properly segregate the hot work operator from nearby combustibles: • Welding Curtains shall be placed so as to prevent openings at the junction of the Welding Curtains. • Welding Blankets shall be placed at the bottom of Welding Curtains to close the gap between the Welding Curtain and the non-combustible floor. • The Welding Blanket shall curve to the inside of the Welding Blanket perimeter, not to the outside. • The hot work operator shall be enclosed in a manner that will prevent sparks or slag from migrating outside of the enclosed area. • PAI must sign CFN-1139 under the section requiring PAI work control verification in accordance with Appendix E, Notes 3A and 3B. Hot work areas must remain free of all combustibles (i.e., personal belongings and backpacks) until the permit is closed out or temporary suspended by the PAI as documented on CFN-1139. *Note: When hot work activities are paused by the PAI, all controls must remain implemented for at least 30 minutes following the conclusion of hot work activities. Multiple hot work suspension and restarts are acceptable with the approval of the PAI. Before work can be re-started, the PAI shall ensure conditions are appropriate for work to proceed. The PAI shall DOCUMENT the re-start time in the appropriate section of CFN-1139.*
			IF floors (including temporary flooring material) are combustible, THEN perform any
			the following:
			o Keep floors wet

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Activity	Sub-Activity	Hazard	Control
			o Protect with welding blanket or welding pad
			· IF floors have been wetted down AND personnel are operating arc welding equipment or cutting equipment, THEN ensure personnel will be protected from possible shock
			· IF combustible materials (e.g., clippings, wood shavings, or textile fibers) are on the floor within the hot work area, THEN remove the material from the floor
			· Ensure all combustibles that can be relocated are moved at least 35 feet in all directions away from the hot work operation
			· IF relocation of combustibles is impractical, THEN ensure combustibles are protected by any of the following:
			o Welding blanket
			o Welding curtain
			o Welding pad
			· IF floor and wall openings are present within 35 feet of the work location, THEN ensure the openings are protected as noted in the hot work permit
			· IF ducts and conveyor systems that might carry sparks to distant combustibles are present within the work site, THEN protect the ducts and conveyor systems by shielding, shut down, or both
			· IF hot work is done near any of the following:
			o Walls
			o Partitions
			o Ceilings
			o Roofs of combustible construction
			· THEN ensure they are protected by any of the following:
			o Welding curtain
			o Welding blanket

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Activity	Sub-Activity	Hazard	Control
			o Welding pad
			· IF hot work is done on one side of the following AND combustibles are on the other side of the following:
			· A wall
			· Partition
			· Ceiling
			· Roof
			· THEN perform one of the following:
			o Ensure precautions have been taken to prevent ignition of combustibles on the other side by relocating the combustibles, OR
			o Ensure a Fire Watch is provided on the side opposite from where the work is being performed
			o Ensure hot work will NOT be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation
			o Ensure hot work will NOT be attempted on walls or partitions of combustible sandwich-type panel construction
			o IF hot work is close enough to cause ignition by conduction while performing hot work on pipes or other metal that is in contact with combustibles, such as, but not limited to the following:
			· Combustible walls
			· Combustible partitions
			· Combustible ceilings
			· Combustible roofs
			o THEN prohibit hot work from being performed
			o Ensure a fully charged and inspected 10-pound (minimum), Class ABC dry chemical or equivalent fire extinguisher is available at the work area

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			o IF hot work will be performed in an area protected by a sprinkler system when the system is impaired, THEN the requirements of National Fire Protection Association (NFPA) 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, must be met, and ensure approval by the BNI FPE (or designee) is documented on CFN-1139
			o Ensure the operator and nearby personnel are suitably protected against dangers such as heat, sparks, and slag. Refer to the Job Hazard Analysis or UPF-CP-205, *Personal Protective Equipment and Safe Work Apparel*, for the appropriate selection to minimize the potential for ignition, burning, trapping hot sparks, and electric shock.
			o IF hot work will be performed in a hot work Permit-Required Area, THEN ensure the area has been inspected by a PAI
			o IF hot work will be performed in a Designated Area, THEN ensure the inspection of the work location is documented and approved on Section 1 of CFN-1137
Hot Work	Hot Work Operator Requirements	Fire	Ensure the following:
			· The requirements pertaining to wall opening protection and pertaining to ducts and conveyor opening protection are fulfilled.
			· Ventilation is working properly
			· Equipment is in working order
			· IF hot work will be performed in a hot work Permit-Required Area, THEN ensure the area has been inspected by a PAI
			· IF the PAI approves of the Permissible Area, THEN perform hot work in accordance with the applicable work package
			· Use exhaust ventilation devices (e.g., moveable ducts/hoods or portable exhaust units) to remove welding fumes or other airborne contaminants arising from hot work operations as near to the source as possible as determined by Environmental, Safety,
			and Health (ES&H)
			· Ensure work is confined to the area or equipment specified

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			· IF conditions covered by a Hot Work Permit change during hot work operations
			· THEN perform the following:
			o Stop Work
			o Notify the PAI
			o IF the conflicting condition cannot be corrected, THEN request the PAI to close the permit and initiate a new Hot Work Permit with additional controls
Hot Work	Fire Watch	Fire	A single Fire Watch can support multiple co-located hot work operations as long as:
			· The hot work activities are within the same permitted location and covered by a single hot work permit
			· The hot work operations can be observed from the same observation position, and must have clear line-of-sight to the operation
			· Clear communication exists between each hot work operation and the Fire Watch
			· The Fire Watch has clear access to the hot work operation to allow for quick response
			· In a Permit-Required Area, observe hot work operations to ensure fire safe conditions, as specified in the Hot Work Permit, are maintained
			· Remain in the area for at least 30 minutes after the completion of hot work operations to detect and extinguish smoldering fires
			· Close CFN-1139 once the hot work operation and Fire Watch responsibilities are complete.
Welding, Cutting, and Brazing	General Requirements	Inhalation of Coating Fume Burns Flying Particles Arc Flash Shock Fire (Hot Work)	· Review ***Attachment 1, UPF Welding General Awareness Training D 52017376 / Q52011751*** · Where welding and pre-heating is planned in the open, all coatings shall be stripped back a distance of a minimum of two (2) inches from the area of heat application. This distance shall be increased to a minimum of four (4) inches where welding or thermal cutting is planned in a confined area. The area of heat application means the surface area that the flame or arc contacts and any adjacent surface whose temperature may be appreciably raised by heat transfer. This also includes the backside of the weld joint when it's accessible.

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		Ingestion	· Wear a shirt, jacket, or equivalent that meets the requirements of Hazard Risk Category 2 (in accordance with NFPA 2112)
			· Wear pants/trousers made from heavier materials (e.g., heavy cotton, denim) that overlap footwear to prevent spatter from entering
			· Wear clothing that is free from pockets, hoods, or cuffs that can trap sparks or slag. Keep sleeves and collars buttoned
			NOTE: *Pockets that are covered or equipped with closeable flaps are acceptable.*
			· For heavy work (e.g., Carbon Arc Cutting over 500Amps, Oxyfuel Gas Weld over 1/2" plate), flame-resistant leggings or other equivalent means shall be used to give added protection to the legs, when necessary
			· Cape sleeves or shoulder covers with bibs made of leather or other flame-resistant material shall be worn during overhead welding, cutting, or other operations, when necessary
			· Additional evaluation of hot work PPE will be performed during the hot work permit process and pre-job FLHA briefing
			· Wear heat resistant gloves with extended/gauntlet cuff as listed on ML-SH-801768-A003, *UPF Glove Matrix*
			· Reference ML-SH-801768-A002, **UPF Eye and Face Protection List**
			· Install welding screens or other guards or barriers around the welding area OR when these are not feasible utilize other means (i.e., signs, spotters, etc.) to adequately notify and protect adjacent personnel
			· Visually inspect all welding leads and cables for damage prior to use
			· Ensure cords and leads are protected from damage by properly routing overhead and/or out of walkways or travel paths utilize insulated hooks, straps, or zip-ties to secure them. Do not route over sharp corners or edges that can cause damage

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			· Standard 120-volt extension cords and 208-volt (single-phase twist lock) extension cords are a tool of the trade and craft persons can plug or unplug these cords after shedding the load (e.g., turning off the welder, tool, or heater)
			· Only Temporary Power Electricians can plug in, unplug, or route 480-volt cord sets
			NOTE: *Only Temporary Power Electricians can operate or reset any breakers in temporary electrical equipment such as panel boards.*
			· If not in a Designated Hot Work Area, contact the Permit Authorizing Individual (PAI) for a Hot Work Permit and follow the permit requirements
			· Employ good personal hygiene techniques such as washing your hands before drinking, eating, or smoking
			· Maintain proper body positioning by keeping head away from the generated fumes to minimize exposure during welding, cutting, and brazing
Welding, Cutting, and Brazing	Soldering & Brazing	UV Exposure Fire Burn	Wear safety glasses and a welding hood with a lens shade as follows:
			· Soldering – 2
			· Brazing – 3
			· **Outdoors:** Ensure adequate natural ventilation, no additional controls.
			Indoors: Ensure adequate general/mechanical ventilation, no additional controls required.
			Enclosed Areas/Confined Spaces: Contact IH for additional and specific controls for the conditions at hand.
Welding, Cutting, and Brazing	Material Fit-up/Tack Weld Activities	Arc – Flash Burns	Support personnel in the immediate area assisting with the weld/hotwork activities (i.e., tacking supports) must wear PPE appropriate to the hazard (e.g., gloves, category 2 weld shirt/jacket, shaded glasses, face shield, etc.)
			NOTE: *The "immediate area" consists of the direct work face, weld screened area, aerial lift platform/basket, etc.*

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JHA TITLE:	**Fire Prevention, Protection, Hot Work and Welding**	**WORK PACKAGE NUMBER:**	**N/A**	**SPECIFIC LOCATION:**	**N/A**

Activity	**Sub-Activity**	**Hazard**	**Control**
			· The assigned PPE is to protect workers from secondary hazards created by the activity (e.g., sparks, slag, weld arc, flying debris) and is not intended to protect personnel directly watching the weld process.
Welding, Cutting, and Brazing	Shielded Metal Arc Welding (SMAW) on Carbon Steel (Stick Welding)	Inhalation of Welding Fume Arc Flash	**Outdoors**: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area.
			When ventilation is not feasible, at a minimum, a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			Indoors or Enclosed Areas: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area.
			When local exhaust ventilation is not feasible, establish means of adequate general/mechanical ventilation AND at a minimum, use a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			Barricade and Signage: If local exhaust ventilation requirement cannot be met, install danger barricade tape with completed danger signs or tags around the welding activity to adequately protect adjacent personnel.
			Wear safety glasses and a welding hood with a lens shade as follows:

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<table>
<tr><th>Activity</th><th>Sub-Activity</th><th>Hazard</th><th>Control</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Electrode Size - in. (mm)</th><th>Arc Current (Amperes)</th><th>Minimum Protective Shade</th><th>Suggested* Shade No. (Comfort)</th></tr>
<tr><td>Less than 3/32 (2.4)</td><td>Less than 60</td><td>7</td><td>10 (*)</td></tr>
<tr><td>3/32 - 5/32 (2.4 - 4.0)</td><td>60 - 160</td><td>8</td><td>10</td></tr>
<tr><td>5/32 - 1/4 (4.0 - 6.4)</td><td>160 - 250</td><td>10</td><td>12</td></tr>
<tr><td>More than 1/4 (6.4)</td><td>250 - 550</td><td>11</td><td>14</td></tr>
</table>
</td></tr>
<tr><td>Welding, Cutting, and Brazing</td><td>Flux Cored Arc Welding (FCAW) on Carbon Steel</td><td>Arc Flash (FCAW on Carbon Steel)</td><td>
Wear safety glasses and a welding hood with a lens shade as follows:
<table>
<tr><th>Arc Current (Amperes)</th><th>Minimum Protective Shade</th><th>Suggested* Shade No. (Comfort)</th></tr>
<tr><td>Less than 60</td><td>7</td><td>-</td></tr>
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<tr><td>250 - 500</td><td>10</td><td>14</td></tr>
</table>
Outdoors: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area OR establish means of adequate general/mechanical ventilation AND at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
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<tr><td></td><td></td><td></td><td>· Barricade and Signage: If local exhaust ventilation requirement cannot be met, install danger barricade tape with completed danger signs or tags around the welding activity to adequately protect adjacent personnel.</td></tr>
<tr><td rowspan="5">Welding, Cutting, and Brazing</td><td rowspan="5">Gas Tungsten Arc Welding (GTAW)/Tungsten Inert Gas (TIG) on Carbon Steel</td><td rowspan="5">Arc Flash
Inhalation of Welding Fume</td><td>Wear safety glasses and a welding hood with a lens shade as follows:</td></tr>
<tr><td>
<table>
<tr><th>Arc Current (Amperes)</th><th>Minimum Protective Shade</th><th>Suggested* Shade No. (Comfort)</th></tr>
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<tr><td>50 - 150</td><td>8</td><td>12</td></tr>
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</table>
</td></tr>
<tr><td></td></tr>
<tr><td>· Outdoors: Ensure adequate natural ventilation, no additional controls.
Indoors: Ensure adequate general/mechanical ventilation, no additional controls required.
Enclosed/Confined Areas: Contact IH for additional and specific controls for the conditions at hand.</td></tr>
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Activity	**Sub-Activity**	**Hazard**	**Control**
Welding, Cutting, and Brazing	Plasma Arc Cutting of Carbon Steel	Arc Flash Inhalation of Torch Cutting Fume	

Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Less than 20	4	4
20 - 40	5	5
40 - 60	6	6
60 - 80	8	8
80 - 300	8	9
300 - 400	9	12
400 - 800	10	14

Outdoors: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area OR provide adequate general/mechanical ventilation.

When ventilation is not feasible, at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.

Barricade and Signage: If local exhaust ventilation requirement cannot be met, install danger barricade tape with completed danger signs or tags around the cutting activity.

· **Indoors or Enclosed Areas**: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area WHEN local exhaust ventilation is not feasible, at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required AND provide adequate general/mechanical ventilation.

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JHA TITLE:	**Fire Prevention, Protection, Hot Work and Welding**	**WORK PACKAGE NUMBER:**	**N/A**	**SPECIFIC LOCATION:**	**N/A**

Activity	**Sub-Activity**	**Hazard**	**Control**
Welding, Cutting, and Brazing	Torch Cutting of Carbon Steel	Arc Flash Inhalation of Torch Cutting Fume	**Outdoors**: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area OR provide adequate general/mechanical ventilation.
			When ventilation is not feasible, at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			Barricade and Signage: If local exhaust ventilation requirement cannot be met, install danger barricade tape with completed danger signs or tags around the cutting activity to adequately protect adjacent personnel.
			· **Indoors or Enclosed Areas**: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work Area When local exhaust ventilation is not feasible, at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required AND provide adequate general/mechanical ventilation.
Welding, Cutting, and Brazing	Welding or Thermal Cutting of Galvanized Coated Steel	Fume Generation	All galvanized coatings shall be stripped back to the extent possible from the area of heat application and the following controls shall apply:
			Where possible, use non-heat generating cutting methods (e.g., portaband).
			Outdoors: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area OR provide adequate general/mechanical ventilation.
			When ventilation is not feasible, at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.

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Activity	**Sub-Activity**	**Hazard**	**Control**
			Barricade and Signage: If local exhaust ventilation requirement cannot be met, install danger barricade tape with completed danger signs or tags around the welding activity to adequately protect adjacent personnel.
			· **Indoors or Enclosed Areas**: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) OR discharge exhaust air outdoors to a location that does not affect other workers or allow exhaust air to be drawn back into the work area.
Welding, Cutting, and Brazing	Nelson Stud Welding Machine	Arc Flash Flying Particles	· Use a filter lens of three (3) or greater
			o Wear safety glasses or goggles with a face shield.
Welding, Cutting, and Brazing	Gas Tungsten Arc Welding (GTAW) / Orbital Welding on Stainless Steel, Hastelloys and Inconels	Hexavalent Chromium Inhalation of Welding Fume Arc Flash	Remove welding residue and debris from work clothing using a HEPA filtered vacuum prior to leaving the work area for scheduled breaks and at the end of the work shift.
			Clean the welding work area using a HEPA vacuum or a method to minimize dust generation (e.g., wet the debris or use floor sweep) at the termination of the welding activity.
			Outdoors: Ensure adequate natural ventilation, no additional controls.
			Indoors: Ensure adequate general/mechanical ventilation, no additional controls.
			Enclosed/Confined Areas: Contact IH for additional and specific controls for the conditions at hand.
			Wear safety glasses and a welding hood with a lens shade as follows:

Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Less than 50	8	10
50 - 150	8	12
150 - 500	10	14

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Activity	**Sub-Activity**	**Hazard**	**Control**
Welding, Cutting, and Brazing	Gas Metal Arc Welding (GMAW/Metal Inert Gas (MIG) on Stainless and Carbon Steel	Hexavalent Chromium Inhalation of Welding Fume Arc Flash	Remove welding residue and debris from work clothing using a HEPA filtered vacuum prior to leaving the work area for scheduled breaks and at the end of the work shift.
			Clean the welding work area using a HEPA vacuum or a method to minimize dust generation (e.g., wet the debris or use floor sweep) at the termination of the welding activity.
			Outdoors: Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) AND at a minimum, a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			When local exhaust ventilation is not feasible, provide adequate general/mechanical ventilation AND at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			Indoors or Enclosed Areas: Provide local exhaust ventilation with a capacity of 10 linear feet per minute per welder/operator and with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) AND at a minimum, a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required.
			Barricade and Signage: Install danger barricade tape with completed danger signs or tags around the welding activity to adequately protect adjacent personnel.
			Wear safety glasses and a welding hood with a lens shade as follows:

Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Less than 60	7	-
60 - 160	10	11
160 - 250	10	12
250 - 500	10	14

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Activity	**Sub-Activity**	**Hazard**	**Control**
Welding, Cutting, and Brazing	Plasma Arc Cutting of Stainless Steel Hastelloys, and Inconels	Hexavalent Chromium Inhalation of Welding Fume Arc Flash	Remove plasma arc cutting residue and debris from work clothing using a HEPA vacuum prior to leaving the work area for scheduled breaks and at the end of the work shift. Clean the plasma arc cutting work area a HEPA vacuum or a method to minimize dust generation (e.g., wet the debris or use floor sweep) at the termination of the welding activity. Provide local exhaust ventilation with a capacity of 100 linear feet per minute per welder/operator with an inline high efficiency particulate air (HEPA) filter (i.e., fume extractor) AND at a minimum a half-face Air Purifying Respirator (APF 10) with a HEPA/P 100 filter is required. When local exhaust ventilation is ineffective or not feasible, wear a PAPR (i.e. Adflo and L-905SG helmet) AND provide adequate general/mechanical ventilation. **Barricade and Signage**: Install danger barricade tape with completed danger signs or tags around the welding activity to adequately protect adjacent personnel. Wear safety glasses and a welding hood with a lens shade as follows:
		Fire Explosion	If not in a Designated Hot Work Area, contact the Permit Authorizing Individual (PAI) for a Hot Work Permit and follow the permit requirements.

Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Less than 20	4	4
20 - 40	5	5
40 - 60	6	6
60 - 80	8	8
80 - 300	8	9
300 - 400	9	12
400 - 800	10	14

UPF JOB HAZARD ANALYSIS

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Activity	**Sub-Activity**	**Hazard**	**Control**
Welding, Cutting, and Brazing	Exothermic Welding (Cad Welding)	Burns Arc Flash Flying Debris Inhalation of Welding Fume	Where storage near the point of use is necessary, maintain Cad Welding at least ten (10) feet away from the point of use and limited to a supply necessary for one workday. Use an approved flammable material storage cabinet, keep the area dry and the cabinet locked.
			Ensure Cad Weld exothermic weld molds are dried thoroughly before igniting the charge and provided with a cover. When the charge has been ignited, the operator will move at least ten (10) feet from the charge.
			Containers for the starting material shall be closed tightly immediately after each use.
			Smoking is not permitted in areas where Cad Welding material is being used or stored.
			Wear a shirt, jacket, or equivalent that meets the requirements of Hazard Risk Category 2 (in accordance with NFPA 2112).
			Wear pants/trousers made from heavier materials (e.g., heavy cotton, denim) that overlap footwear to prevent spatter from entering.
			Wear clothing that is free from pockets, hoods, or cuffs that can trap sparks or slag. Keep sleeves and collars buttoned.
			NOTE: *Pockets that are covered or equipped with closeable flaps are acceptable.*
			When using a hand striker, wear safety glasses or goggles and a face shield with a filter lens of three (3) or greater.
			Where Cad Welding is planned in the open, all coatings in way of the Cad Welding shall be stripped back a minimum of two (2) inches from the area of heat application. This distance shall be increased to a minimum of four (4) inches where Cad Welding is planned in an enclosed or confined space. The area of heat application means the surface area that the flame or arc contacts and any adjacent surface whose temperature may be appreciably raised by heat transfer.
			Outdoors: Assure adequate natural ventilation. Maintain body position away from the generated fumes and use a remote striker when feasible.

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Activity	**Sub-Activity**	**Hazard**	**Control**
			· **Indoors**: Contact IH to determine exposure assessment prior to commencing work and identify applicable work controls.
Operation of an Internal Combustion Engine in a Building or Enclosed Area	General Requirements	Inhalation of Carbon Monoxide, Nitrogen Dioxide, and/or other Combustion Gases Chemical Asphyxiation	· Select and use non-combustion powered equipment where feasible (battery-powered) OR
			· Select propane powered equipment over diesel and gasoline when feasible
			· Discharge engine exhaust outside the building or enclosed space using local exhaust ventilation OR
			· Ensure the building/area has adequate general/mechanical ventilation AND operate internal combustion engines intermittently only when needed to minimize the accumulation of combustion gasses AND where feasible open doors, windows or other such openings to promote natural ventilation OR
			· If the ventilation requirements established above cannot be met, the following controls will apply:
			o Monitor for carbon monoxide on a continuous basis OR until which time air monitoring results indicate that carbon monoxide concentrations are not capable of exceeding applicable exposure limits
			· If at any time during monitoring the instrument alarm sounds, promptly STOP work, exit the immediate work area or enclosed space and contact supervision and ES&H

THE NATION'S URANIUM PROCESSING FACILITY

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Ensure a new corresponding CFN-1251, *UPF Construction Attendance Sheet*, is signed and inserted in the CWP to document JHA briefing.					
PREPARER:	Anton Panev Printed Name/Signature			11/22/24 Date	
APPROVAL:					
ES&H:	Robert Drake Printed Name/Signature			11/22/24 Date	
SITE MANAGER: (COI-CM-801768-A087)	Dustin Reddick Printed Name/Signature			11/25/24 Date	

UPF Welding General Awareness Training

Revision Log

Revision	Description	Intent	Non-Intent
0	Initial Issue	X	

UPF Welding General Awareness Training

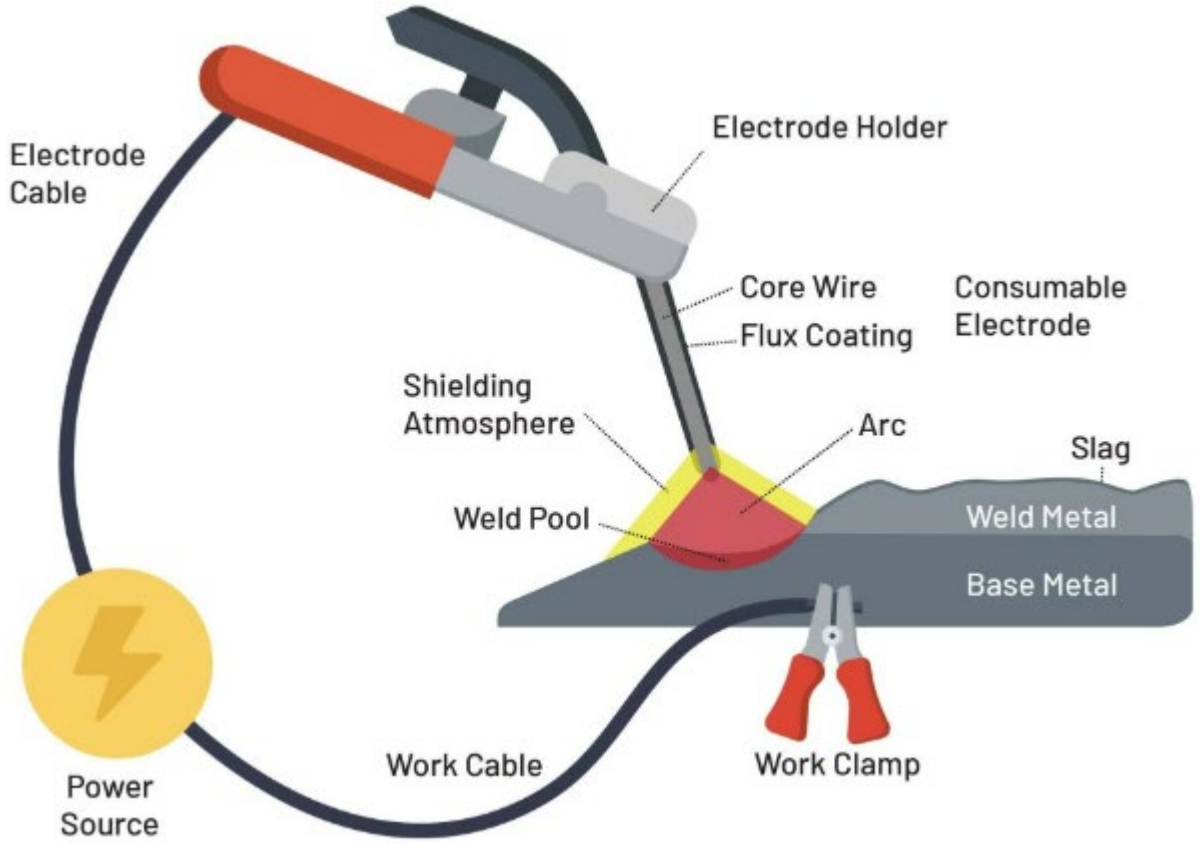
Course Objectives

During this course, we will discuss:

- Welding fume management controls
- Health affects associated with inhalation of welding fumes and management controls
- Removal of protective coatings
- Noise and vibration associated with welding activities as well as Ultraviolet Radiation (UV)
- Work area hazards when welding operations
- Exposure assessments associated with welding operations

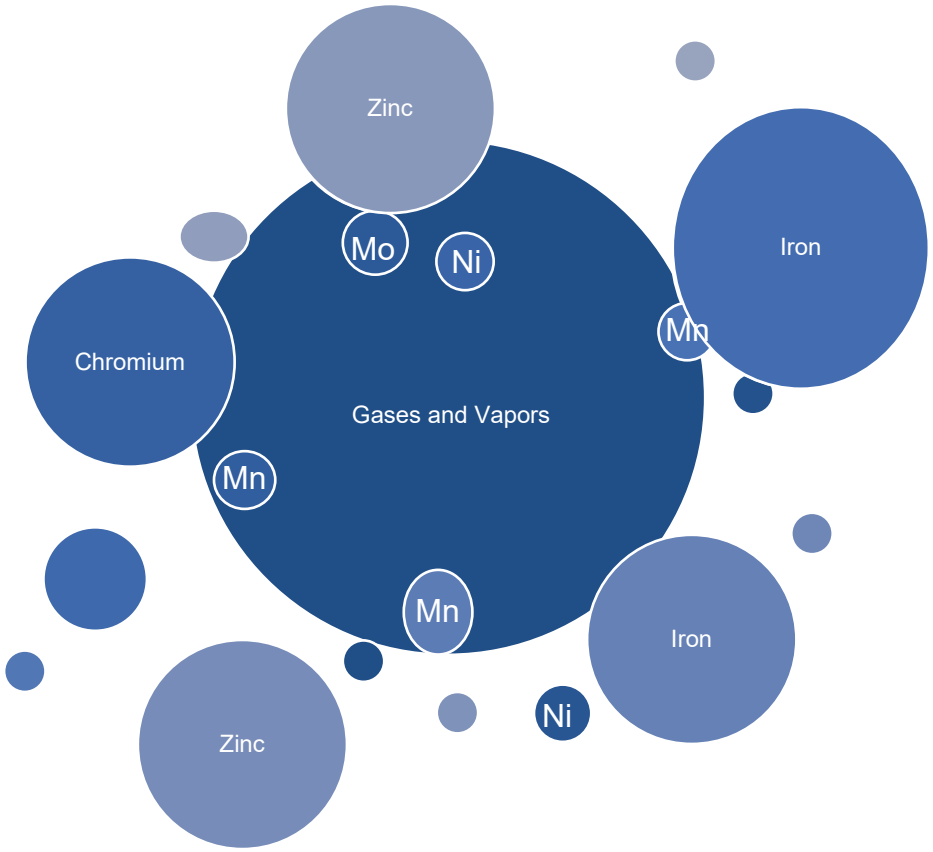
Welding Process

- Welding is a major industrial process used for joining metals together to form a strong joint.
- Fumes are produced by vaporization of the base metal and flux components of the electrode.
- These fumes can be inhaled by welders and adjacent workers.
- Types of welding or cutting used on site that may generate fumes include:
  - Shielded Metal Arc Welding (SMAW)
  - Gas Tungsten Arc Welding (GTAW/TIG)
  - Gas Metal Arc Welding (GMAW/MIG)
  - Flux Cored Arc Welding (FCAW)
  - Nelson Stud Welding
  - Plasma Arc Cutting
  - Exothermic Welding
  - Torch Cutting

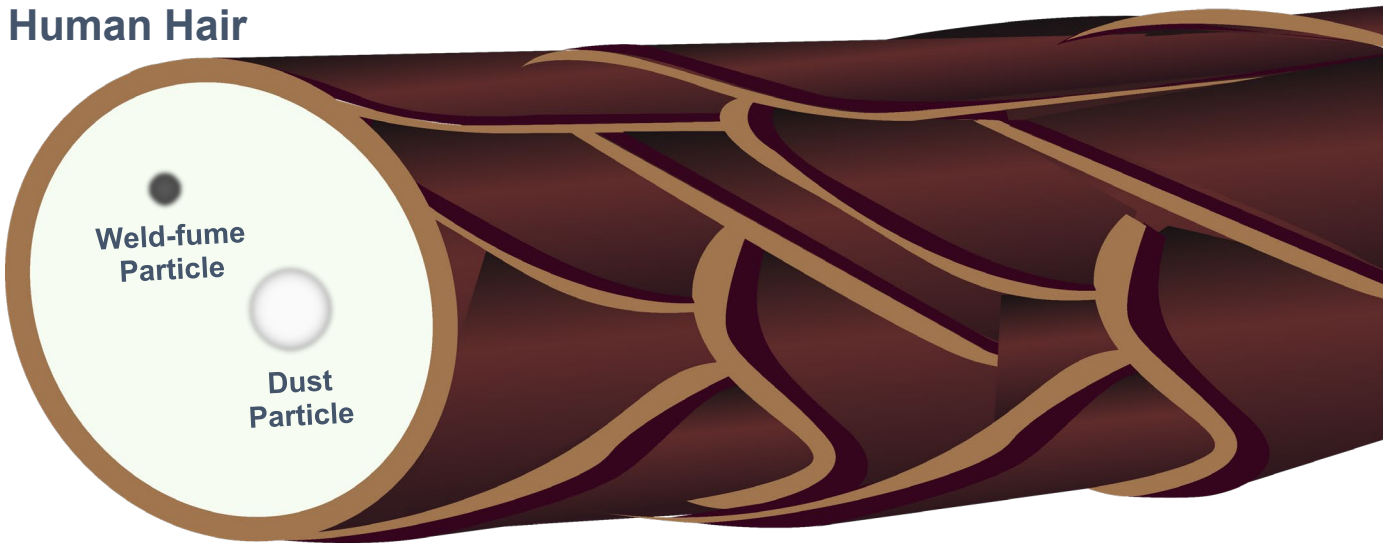


Welding Process

- Welding fumes are made of very small, and thus easily inhaled solid particles, that come from welding consumables, base metals, and base metal coatings.



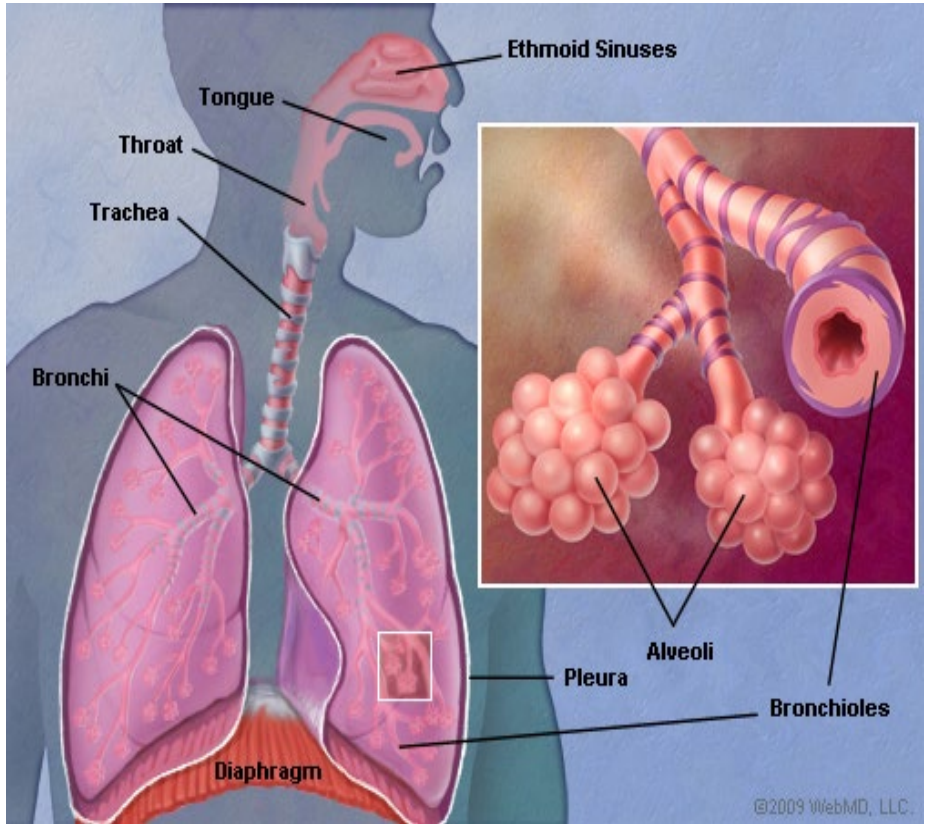
Relative Size of Weld-Fume Particles



Weld-fume particles come from consumable electrodes, molten puddles, shielding gases, base metals, or previously applied paint/surface coatings.

Health Affects - Inhalation of Welding Fume

Inhalation of welding fume solid particulates can lead to adverse health affects



The most serious damage is caused by contaminants that penetrate deep into the lower regions of the lung (alveoli).

- **Cadmium** - Irritation of respiratory system, sore and dry throat, chest pain and breathing difficulty. Chronic effects include kidney damage and emphysema. Suspected **carcinogen**.
- **Chromium** - Increased risk of lung cancer. Some individuals may develop skin irritation. Some forms are **carcinogens** (**Hexavalent Chromium**).
- **Nickel** - Acute effect is irritation of the eyes, nose and throat. Increased cancer risk has been noted in occupations other than welding. Also associated with dermatitis and lung problems.
- **Total Welding Fume** - “Metal Fume Fever”. A **carcinogen.** Other chronic effects include damage to the respiratory
- **Manganese** - Chronic effects may include central nervous system problems. Ototoxic and therefore risk of hearing loss.

Welding Fume Management Controls

- Local Exhaust - Place the nozzle of the fume extractor as close to the weld as possible. If visible fume is seen escaping the fume extractor, it is not placed close enough

Note: Do not modify the fume extraction equipment either by linking sections of hose or altering the nozzle. Monitor the filter loading indicator and change the filters accordingly.

- Body Positioning - keep your head away from the generated fumes to minimize exposure
- Respiratory Protection and Barricades - controls depend on the welding process used as well as the filler materials and base metal; requirements are listed in your Job Hazard Analysis

Protective Coatings

- Coating removal of weld joint includes the immediate area (minimum 2” or 4” depending on work area) and the back side (when accessible) of the weld joint (the same distance). The pictures below highlight what happens if the coatings are not removed properly.

Note: 2” removal is a minimum. If off-gassing is experienced during welding activities, additional coatings will need to be removed to eliminate the hazard (inhalation of coating fumes).

- Coating removal also needs to be addressed at the weld joint for preheat activities. If coating damage or off-gassing is experienced during preheat activities, additional coatings will need to be removed to eliminate the hazard (inhalation of coating fumes).

Note: Electric heat guns can be used as an alternative means to pre-heat material.

Noise and Vibration

- Welding and Hot Work activities can generate high levels of occupation noise and vibration
- Implement the work controls detailed in your JHA

- Specific information is can be found in the following documents:
  - ML-SH-801768-A011, *Sound Levels of Common Construction Power Tools*
  - ML-SH-801768-A008, *Power Tools Hand-arm Vibration Levels*

Ultraviolet (UV) Radiation

- UV radiation can produce an injury to the surface and mucous membrane (conjunctiva) of the eye called "arc flash“.
- The symptoms include:
  - –pain - mild feeling of pressure to intense pain in severe instances
  - –tearing and reddening of the eye and membranes (bloodshot)
  - –sensation of "sand in the eye"
  - –abnormal sensitivity to light

Ultraviolet (UV) Radiation

- Wear the appropriate personal protective equipment detailed in your JHA
- **DO NOT LOOK at Welding Arc unprotected**
- Locate welding operations so that other workers are not exposed to either direct or reflected radiation
- Personnel adjacent to the welding areas can be protected from the arc welding ultraviolent radiation rays by noncombustible or flameproof screens

Work Area Hazards

- Simultaneous operations (SIMOPS) with other adjacent crews
  - Follow requirements specified in the Hot Work Permit
  - Leverage the FLHA Process to document and communicate the work area hazards with all affected crews
- SIMOPS Considerations:
  - Hot work activities adjacent to application of specialty coatings
  - Cutting/grinding (noise) in close proximity to other unprotected personnel
  - Respirator required hot work activities close to unprotected personnel
  - Hot work performed next to solvent cleaning of stainless steel equipment

Exposure Assessments

- The project has performed exposure assessments for all types of welding used on site (SMAW, GTAW, GMAW, FCAW).
- The project complies with the more stringent of the ACGIH TLV (2016) or OSHA PEL.
  - Manganese, 0.02 mg/m^3 as a respirable particle or 0.1 mg/m^3 as an inhalable particle ACGIH TLV (2016).
  - Hexavalent Chromium, 5 $\mu gm/m^3$ OSHA PEL.

- Controls resulting from these exposure assessments have been flown down into Job Hazard Analyses.