Approved

ORNL WORK PLAN

Operations, Maintenance and Services

40528

Work Plan Name / Rev: FAB WELDER 5300 GR3 / 13
Expiration Date: 2/20/2026

WORK SCOPE/DESCRIPTION	
Requester (Name/Badge/Division):	Williams Jr, Sam / 00940082 / X207
Location of work (Bldg/Rm/Other):	5300 / N1162 / North 1 fab shop
Work Plan Title:	Welder Grade GR3 Tasks

Description of Service/Work Needed:
Grade 3 tasks have been determined to be within the skill set of craft personnel performing the assigned work. Typically grade 3 work plans include 1 or more requirements for permits (hot work, confined space, etc) NDE or quality verification documentation, Material Test Reports, or other documented criteria as directed by the assigned supervisor in charge of the work. General work scope for this grade 3 work plan includes but is not limited to: Welding, burning, and brazing using several different processes, grinding, chipping, brushing, and equipment setup as directed by the assigned supervisor in charge of the work. Support other craft within the skillset and capabilitiy of assigned personnel as directed and approved by the supervisor in charge.

Charge Number, if required:	3F893036
Work Plan Grade/Worktype:	3 / 0
Author (Name/Badge):	Williams Jr, Sam / 00940082

File Attachments:

Badge	Name	Attachment Desc	File Name
03084814	Helton, Zach	Exposure Assessment	QEA -- 5300 Fabrication Welder, Gr 3 (1).pdf

INSTRUCTIONS

Prerequisites/Precautions:
Work performed in shop with approved Hot Work/Burning Permit in place. Welding/burning and other hot work requires fire retardant clothing in addition to standard PPE. Full Face Shield or welding hood must be worn while grinding, brushing, or cleaning welds and weld areas using brushes or power equipment. UV/Visible Tinted Lens - Tinted safety glasses must be worn when assisting a welder.
Hazards may include hot metals, grinding sparks, ultraviolet rays, metal fumes, flux fumes, electrical shock; inert, flammable, and oxidizing gases; lifting, bending, and falling. Work poses no Asbestos/Man-made Mineral Fibers, Lead, Beryllium,cadmium, or PCB exposure.
All employees are expected to familiarize their self with equipment prior to using it. This familiarization includes but is not limited to reading and understanding manufacturers warning labels and cautions posted on the equipment. If safe operation instructions are not clearly understood see your supervisor.

Prior to start of work, personnel should evaluate the following 6 questions: If the assigned personnel utilizing this work plan are unsure how to answer any of the following questions, the answer is assumed to be "YES". Contact the assigned supervisor for further clarification.

Any "YES" answer requires that the assigned person return to the supervisor for a re-evaluation.
1. Will I be exposed to hazards at the work location that are not associated with the job?
2. Will I use chemicals or materials for which I do not understand the hazards?
3. Will the job require Personal Protection Equipment (PPE) that I do not normally use or have not been trained to use?
4. Will bystanders or passerby be exposed to job hazards?
5. Will any permits be required?
6. Is there any aspect of the work that I do not feel safe performing?

Directions:
Perform work as requested within scope of work identified above and in accordance with directions on work request.Utilize qualified WPS's (welding procedure specifications) and certified welder's for all welding. Complete job specific Pre-job Safety Review prior to performing work. If work is outside the scope of grade 3 work, suspend work and perform a new work plan evaluation. The use, procurement, and/or disposal of chemicals complies with F&O-1.24 Chemical Procurement and Management. Waste generated is disposed of in accordance with established ORNL procedures. Verbal request and instruction are acceptable and shall be recorded in work package when practical.

Supervisor Authorization
The FMD supervisor is responsible for and must authorize all work activities and work plans associated with this work plan.
Supervisor Responsibility
The FMD supervisor shall ensure the safety of personnel, equipment, and facilities under his/her direct control and ensure that employees are instructed and trained in job-related safety policies, procedures, practices, and conditions.

When work location, scope, or work conditions exceed this work plan, suspend work and report to the assigned supervisor for further instruction.

Post Work Testing:
As required by work order; otherwise, none.

Closeout:
Leave work area hazard free before leaving area. Provide feedback to Supervisor to identify safety concerns or suggest process/work improvements.

JOB HAZARD EVALUATION	
HAZARDS	PERMITS / CONTROLS
Welding/burning/hot work: (Designated area hot work permit	ı Welding/Burning/Hot Work Permit: Welding hot work permit must be in place prior to starting work. Validate that permit is current and all criteria has been met. ı Requires fire retardant clothing in addition to standard PPE. ı Stainless steel welds using flux core arc welding (FCAW) and shielded metal arc welding (SMAW): NOTICE: This procedure when used produces fumes that could result in exposure to high levels of fumes that contain hexavalent chromium. The use of this procedure should be limited and only after other procedures have been considered as an option. Use of this procedure requires approval of ORNL Welding Program Manager and Industrial Hygiene on a case-by-case basis.
Atmospheric Issues - Oxygen enriched/Oxygen deficient	ı Non-sparking tools and equipment ı Atmospheric monitoring ı Ventilation
Boiler, Pressure Vessels, Relief Valves	ı Inspection of vessels ı Labeling or other markings ı Design to ASME code ı Apply Implemented Mitigation Strategies ı Complete / Verify Pre-Startup Activities
Compressed Gas	ı Securing of cylinders ı Segregation of incompatible gases
Electrical Equipment and Tools	ı Listed by a nationally recognized testing laboratory (NRTL)
Ergonomic Conditions (Contact Stress, Vibration, Posture, Force, Repetitive Motion)	ı Exposure Assessment: Enter or attach justification to classify exposure scenario as low risk, qualitative exposure assessment (QEA), or requirement to conduct quantitative exposure monitoring (QEM) ı Diversify activities ı Special Tools (Lifts, etc.)
Flammables	ı Approved storage units ı Keep away from source of ignition
Manual Material Handling: Lifts are not considered to be in a repetitive pattern or monolifting.	ı Establish Controls (Guideline) [apply 30-50-30 criteria for a non-repetitive lifting task] ¡ Reduce weight ¡ Decrease load ¡ Design work area ¡ Facilitate access to material ¡ Optimum environment ¡ Reduce distance /Provide proper storage facilities ¡ Load storage ¡ Eliminate manual lifting/lowering ¡ Eliminate pushing/pulling – Use lifting aids

	¡ Other instructions to staff : Leather or cut resistant glovesto be worn to protect hands from sharp edge. ı Team Lifting (Guideline) ı Consider forklifts or powered industrial trucks: See Power Equipment hazard (formerly Lifting Aides)
Mechanical Material Handling	ı Apply hierarchy of controls approach ı Engage Hoisting and Rigging services for movement of materials (Guideline) ı Consider forklifts or powered industrial trucks: See Power Equipment hazard (formerly Lifting Aides)
Noise	ı Engineering Controls (sound baffles, muffles, barriers, etc.) ı Exposure Assessment: Enter or attach justification to classify exposure scenario as low risk, qualitative exposure assessment (QEA), or requirement to conduct quantitative exposure monitoring (QEM) ı Hearing protection (plugs or muffs): Selecting Hearing Protection ı Hearing Conservation Program ı Workplace monitoring
Other Mechanical Hazards (Machine guarding issues, rotating equipment, sharp objects, pinch points, etc.)	ı Ensure guards are in place if applicable. ı Ensure that safety interlocking devices are functional if equipped. ı Place warning signs or markings ı Workers in area shall not wear loose fitting clothing, jewelry, or other articles that might catch in moving equipment ı Follow manufacturer's operation manual and review any equipment-specific signs, postings, or markings. ı Safe-holding safeguarding ı Use hand-feeding tools or work holding equipment. ı Special operating instructions for stock selection, feed speed, cutting fluids, etc.
Power Equipment	ı Qualified operator ı Perform pre-use check (Exhibit) ı Physical protection (roll bars) ı Hearing protection
Thermal Sources	ı Signs or other markings
Chemical/Rec ID 1: Acetone, Ethyl Alcohol USP, Isopropyl Alcohol	ı Chemical goggles: Required when/if there is a potential for splashing chemicals. ı Gloves: Specify. Chemical protection in accordance with MSDS/SDS. ı Ventilation: Use adequate ventilation; local exhaust, natural air convection or fan. Use safety glasses with side shields; respirator may be used if desired. Empty containers are special waste--take to 7020. Empty metal containers go to metal recycle. ı Safety glasses
Hazardous Waste: Rags used for Cleaning	ı Take to 90-Day or Satellite Area.
Eye and Face Protection	ı Eye/Face Protection: Safety glasses w/side shields: All safety eyewear must have ANSI Z87 clearly marked on all glasses and goggles and should be worn at all times.

	Full Face Shield or welding hood must be worn while grinding, brushing, or cleaning welds and weld areas using brushes or power equipment. UV/Visible Tinted Lens - Tinted safety glasses must be worn when assisting a welder.
Answer the following for this job work location. Any yes answer - contact your supervisor for further instructions before starting work.	Questions:: 1. Will I be exposed to hazards at the work location that are not associated with the job: 2. Will I use chemicals or materials for which I do not understand the hazards? 3. Will the job require Personal Protective Equipment (PPE) that I do not normally use or have not been trained to use? 4. Will bystanders or passersby be exposed to job hazards? 5. Will additional permits be required?)
Grinding sparks, ultraviolet light, metal fumes, flux fumes, electrical shock; inert, flammable, and oxidizing gases	In addition to standard PPE, welding shield and appropriate tinted lens Hazards identified in this JHE section are not to be considered all inclusive or applicable to every task identified above. Workers are expected to perform their own Pre-Job Safety Review prior to performing work to identify any job specific hazards. Exhaust hoods must be located within specified distance from the arc/flame. Welding curtains/screen will be in place.

DOCUMENTATION REVIEW AUTHORIZATION (Approvals are certification of hazards assessment)		
Reviewer/Approver Roles	Signature	Date
Accountable Management (Service Provider, Line, Equipment Owner, or Facility Management)	Brewer, Eric	1/15/2025
Author	Williams Jr, Sam	11/1/2024
IS/IH	Helton, Zach	10/31/2024
Other Subject Matter Experts (SMEs)	Conner, Daniel S	2/20/2025
Review Team Member	Griffin, James	11/1/2024
Task Leader	Williams Jr, Sam	11/1/2024
Work Package Concurrence		
Facility Manager		
Operations Supervisor		
Facility Manager Approval To Start Work		
Facility Manager		
Work Start Authorization		
Task Leader		
Work Acknowledged Complete		
Task Leader		
Worker Feedback:		

Approved
ORNL WORK PLAN
Operations, Maintenance and Services

40528

Work Plan Name / Rev: FAB WELDER 5300 GR3 / 13
Expiration Date: 2/20/2026

PRE-JOB SAFETY REVIEW GUIDE

ID: 40528

Scope of Work: Review work package/plan to ensure all participants understand the work activity.

Hazards: Review the hazards identified in Job Hazard Evaluation (JHE) / work plan (IOP).

- Since the work package / plan was written: 1) Have conditions changed? 2) Are there new hazards? Refer to Field Notes and Focus Areas.

Hazard Controls / Permits: Review:

- Written permits for the work activity.
- Precautions, step warnings, Hold Points ...
- Personal Protective Equipment (PPE)
- Work instructions for information - e.g., steps where hazards are introduced.
- ORNL subject area requirements - e.g., non-permit hazard controls.

Performing Work:

- Discuss group/individual responsibilities for safe & effective work.
- Follow work instructions & safety procedures.
- Availability/location of materials, tools, etc.
- Any previous experiences / lessons learned?
- Response if work cannot be performed as planned.
- What is the worst thing that could happen?
- Are there *Potential error traps* with the job? → →
- Take a minute before: work start & leaving work area.
- Work Hand-off / Turnover - workers & Task Leader

→ Potential Error Traps:

- Time pressures
- Distractive environment
- High workload
- First time evolution
- First day back
- Vague guidance
- Over confidence
- Imprecise communications
- Work stress

Abnormal Situation Response:

- *Stop Work*: Observe an unsafe act, activity or condition that creates an imminent danger.
- *Emergency Response*: Discuss egress paths or other responses if problems are encountered.

Field Notes and Focus Areas: (Use this area as a work space to record notes related to new hazards identified in the field or changed conditions. Record feedback in work package/plan information systems.)

By signing below, I am indicating that I have been briefed on the potential hazards associated with completing this job.

Signature / Badge	Date	Signature / Badge	Date

Qualitative Exposure Assessment – Multiple Hazard Form

Project Information

☐ No QEA is required based upon a review of the type(s) of hazard(s) associated with the activity/task

☐ QEA could not be conducted at the time the RSS/Work Plan was reviewed/approved due to inadequate information provided by the PI, Work Planner/Package author on some or all agent(s)/hazard(s). List the agent(s) for which a QEA could not be conducted: ☐ All Agents (see below) or Specific Agent(s) that could not be assessed: . Discuss controls incorporated into *Work Control* to assure EA is conducted in the future: _____

Process/Job/Task: (SEG/SET Name)
Fabrication / Welder / Various welding, processes (refer to attached table)
Fabrication / Welder / Grinding, chipping, brushing
Fabrication / Welder / Metal cleaning

Work Description: Welding shop work activities include equipment set up, welding and brazing (using several different processes), light grinding, chipping, and brushing. Requirements for documentation to include Material Test Reports, Weld Reports, Section VIII documents, NDE/Inspection Reports make the work level Grade 3. Work poses no asbestos/man-made mineral fibers, lead, beryllium, cadmium, or PCB exposure.

Facility #: 5300 **Room/Lab/Shop #:** North 1

Organization: FIID **RSS/Work Plan #:** FAB WELDER 5300 GR3 / **11**

Agents and Control Information

	Process/Job/Task	Agent	Quantity or Magnitude	[1]Potential Routes of Entry	Primary Exposure Forms	Frequency of Exposure	Duration of exposure per exposure Event	[2]PPE (including Respiratory Protection)	[3]Engineering and Administrative Controls	*OEL	Health Severity Rating 1-4	Exposure Rating 1-4	Certainty Rating 1 - 3	[4]QEA Rating 1-24	[5]Exposure Decision
1	Fabrication / Welder / Grinding, chipping, brushing	noise	< 85 dBA (TWA)	Other	Other	Weekly	< 1/2 hour	HPD	P	85 dBA (TWA)	3	2	1	5	Acceptable (2 - 7)
2	Fabrication / Welder / Grinding, chipping, brushing	chromium	< 0.01 mg/m3 (TWA)	Inh	Particulate	Weekly	< 1/2 hour	EP, FS, G	GV, P	0.5 mg/m3 (TWA)	4	1	1	5	Acceptable (2 - 7)
3	Fabrication / Welder / Grinding, chipping, brushing	nickel	< 0.003 mg/m3 (TWA)	Inh	Particulate	Weekly	< 1/2 hour	EP, FS, G	GV, P	1.5 mg/m3 (TWA)	4	1	1	5	Acceptable (2 - 7)
4	Fabrication / Welder / Grinding, chipping, brushing	aluminum	< 0.01 mg/m3 (TWA)	Inh	Particulate	Weekly	< 1/2 hour	EP, FS, G	GV, P	10 mg/m3 (TWA)	2	1	1	3	Acceptable (2 - 7)
5	Fabrication / Welder / Metal cleaning	acetone	< 4 oz. / day	Inh, S	Vapor	Variable	< 1/2 hour	EP, G	GV, Hood, T, P	250 ppm (TWA; 500 ppm (STEL)	2	1	1	3	Acceptable (2 - 7)
6	Fabrication / Welder / Metal cleaning	ethanol	< 4 oz. / day	Inh, S	Vapor	Variable	< 1/2 hour	EP, G	GV, Hood, T, P	1000 ppm (STEL)	2	1	1	3	Acceptable (2 - 7)

1. Routes of entry codes: Inh – Inhalation, P – Penetration, Ing – Ingestion, S – Splash; A – Absorption; **2. PPE Codes**: COV – Coverall (e.g. Tyvek, Saranex, etc.), CV- Cooling vest , EP – Eye protection, FR – Flame Resistant Clothing, FS – Face Shield; G – Gloves, HPD – Hearing Protection Device, LC – Lab Coat, WH – Welding Helmet , APR – Air Purifying Respiratory , PAPR – Powered Air Purifying Respiratory, SAR – Supplied Air Respirator or SCBA; **3. Engineering Control codes:** GB – Glovebox, GV – General Ventilation, Hood – Other LEV Hood, I/E – Isolate or Enclose Hazard, LH - Lab Hood S – Shielding, W – Wet Methods; **Administrative Control Codes:** T –Training, L/P – Labeling or Postings, P – Written procedure/plan; LT – Limited Stay Time; W/R – Modified Work/Rest Cycle, BEI – Biological Monitoring, MS – Medical Surveillance; **4. QEA Rating** = (Health Severity Rating + Exposure Rating) X Certainty Rating; **5. Exposure Decision:** Acceptable (2-7), Uncertain (8-15), Unacceptable (16-24) * Optional field

Exposure Decision and Follow-up

Qualitative Exposure Assessment – Multiple Hazard Form

	Acceptable Exposure (LOW RISK)		Uncertain and Unacceptable Exposures			
	Was Agent Hazard Acceptable (Low Risk)?	If yes, describe justification for classification as acceptable	Follow-up Priority	Follow-up Schedule	Is Quantitative Monitoring Required?	Recommendations/Comments
1	YES	Exposure is anticipated to be acceptable in this shop because the welder only performs infrequent minor weld clean up. Significant grinding, such as with weld prep, is performed with machining equipment.	_____	_____	___	
2	YES	Personal monitoring. Surrogate data (IHIM 5653 - highest TWA). Total n=43.	_____	_____	___	
3	YES	Personal monitoring. Surrogate data. (IHIM 10723 - highest TWA). Total n = 38.	_____	_____	___	
4	YES	Personal monitoring. Surrogate data. (IHIM 10383 - highest TWA). Total n = 2.	_____	_____	___	
5	YES	Professional judgment. Small use quantities, short duration, high exposure limits, good general ventilation in all locations.	_____	_____	___	
6	YES	Professional judgment. Small use quantities, short duration, high exposure limits, good general ventilation in all locations.	_____	_____	___	

Qualified H&S Professional: Zachary Helton **Date:** 10/31/2024

Qualitative Exposure Assessment – Multiple Hazard Form

Project Information

☐ No QEA is required based upon a review of the type(s) of hazard(s) associated with the activity/task

☐ QEA could not be conducted at the time the RSS/Work Plan was reviewed/approved due to inadequate information provided by the PI, Work Planner/Package author on some or all agent(s)/hazard(s). List the agent(s) for which a QEA could not be conducted: ☐ All Agents (see below) or Specific Agent(s) that could not be assessed: . Discuss controls incorporated into *Work Control* to assure EA is conducted in the future: _____

Process/Job/Task: (SEG/SET Name) Fabrication / Welder / Various welding, processes
Fabrication / Welder / Metal cleaning

Work Description: Occasionally clean metal using isopropanol when required by the job requester.

Facility #: 5300 **Room/Lab/Shop #:** North 1

Organization: FIID **RSS/Work Plan #:** FAB WELDER 5300 GR3 / 11

Agents and Control Information

	Process/Job/Task	Agent	Quantity or Magnitude	[1]Potential Routes of Entry	Primary Exposure Forms	Frequency of Exposure	Duration of exposure per exposure Event	[2]PPE (including Respiratory Protection)	[3]Engineering and Administrative Controls	*OEL	Health Severity Rating 1-4	Exposure Rating 1-4	Certainty Rating 1 - 3	[4]QEA Rating 1-24	[5]Exposure Decision
1	Fabrication / Welder / Metal cleaning	isopropanol	< 4 oz. / day	Inh, S	Vapor	Variable	< 1/2 hour	EP, G	GV, Hood, T, P	200 ppm (TWA); 400 ppm (STEL)	3	2	1	5	Acceptable (2 - 7)
2															
3															
4															
5															
6															

1. Routes of entry codes: Inh – Inhalation, P – Penetration, Ing – Ingestion, S – Splash; A – Absorption; **2. PPE Codes**: COV – Coverall (e.g. Tyvek, Saranex, etc.), CV- Cooling vest , EP – Eye protection, FR – Flame Resistant Clothing, FS – Face Shield; G – Gloves, HPD – Hearing Protection Device, LC – Lab Coat, WH – Welding Helmet , APR – Air Purifying Respiratory , PAPR – Powered Air Purifying Respiratory, SAR – Supplied Air Respirator or SCBA; **3. Engineering Control codes:** GB – Glovebox, GV – General Ventilation, Hood – Other LEV Hood, I/E – Isolate or Enclose Hazard, LH - Lab Hood S – Shielding, W – Wet Methods; **Administrative Control Codes:** T –Training, L/P – Labeling or Postings, P – Written procedure/plan; LT – Limited Stay Time; W/R – Modified Work/Rest Cycle, BEI – Biological Monitoring, MS – Medical Surveillance; **4. QEA Rating** = (Health Severity Rating + Exposure Rating) X Certainty Rating; **5. Exposure Decision:** Acceptable (2-7), Uncertain (8-15), Unacceptable (16-24) * Optional field

Exposure Decision and Follow-up

	Acceptable Exposure (LOW RISK)		Uncertain and Unacceptable Exposures			
	Was Agent Hazard Acceptable (Low Risk)?	If yes, describe justification for classification as acceptable	Follow-up Priority	Follow-up Schedule	Is Quantitative Monitoring Required?	Recommendations/Comments
1	YES	Model calculation. Professional judgment. Small use quantities, short duration, good general ventilation in all locations.	_____	_____	___	
2	___		_____	_____	___	

Qualitative Exposure Assessment – Multiple Hazard Form

3	___		_____	_____	__	
4	___		_____	_____	__	
5	___		_____	_____	__	
6	___		_____	_____	__	

Qualified H&S Professional: Zachary Helton **Date:** 10/31/2024

Qualitative Exposure Assessment – Multiple Hazard Form

QEA Rating Tables

Table 1: Health Severity Rating

Rating		Criteria
HSR		Effects from Over Exposure
1	Negligible	Negligible or **reversible** effects of little concern Note: This applies to chemical agents classified as a *Relatively Harmless Hazard.
2	Minor	Minor or reversible health concern Note: This applies to chemical agents classified as a *Slight Health Hazard. Examples for using this rating for physical agents include: heat fatigue, discomfort from repetitive stress tasks, minor skin burn not requiring medical treatment, etc.
3	Medium	Medium to severe, reversible health concern. Note: This applies to chemical agents classified as a *Moderate Health Hazard. Examples for using this rating for physical agents includes temporary threshold shift in hearing, heat exhaustion, reversible repetitive stress disorders requiring medical intervention, temporary or transient sight impairment, minor skin burns (UV or IR) requiring medical treatment, etc.
4	Major	Major or irreversible health concern. Includes unknown health effects Note: This applies to chemical agents classified as a *High Health Hazard or *Extreme Health Hazard. Examples for using this rating for physical agents include: standard threshold shift in hearing, heat stroke, permanent peripheral nerve or tendon damage, ruptured disc, permanent (total or partial) loss of sight, formation of cataracts, neurological effects, sterility, etc.

***From the *Hazard Classification Guide*, Appendix C, of ORNL Chemical Hygiene Plan**

Table 2: Exposure Rating

Rating		Criteria
1	Negligible/Remote	• Little to no exceedance of 10% of the OEL (i.e., 95th percentile exposure estimate is virtually always less than 10% of the OEL) • No signs or symptoms of exposure • There is sufficient quantitative exposure data to judge exposure • Very little skin contact with Agent is expected • Engineering and administrative controls are in place and functioning • Only diluted chemicals are used in the process • Very low intensity of energy source • Short exposure duration • The phase of the chemical does not allow for route of exposure
2	Low/Occasional	• Exposure >5% exceedance of 10% of the OEL (i.e., 95th percentile exposure estimate lies between 10% of the OEL and 50% of the OEL) • No specific signs or symptoms of exposure • Qualitative monitoring indicates insignificant levels of hazard • Only incidental skin contact with Agent • There is exposure potential • Engineering and administrative controls are available but effectiveness is questionable
3	Medium/Probable	• Exposure >5% exceedance of 50% of the OEL (i.e., 95th percentile exposure estimate lies between 50% the OEL and the OEL) • Air concentrations may exceed established action levels • Routine skin contact with chemical is expected
4	High/Likely	• Exposure >5% exceedance of the OEL (i.e., 95th percentile exposure estimate > OEL) • Signs and symptoms are evident • High generation of airborne particles or vapors

Table 3: Certainty Rating

Rating		Criteria
1	Certain	The environmental agent's exposure profile and health effects are well-understood. The industrial hygienist has high confidence in the acceptability judgment.
2	Uncertain	There is enough information to make a judgment, but further information gathering is warranted to verify the exposure assessment.
3	Highly Uncertain	The acceptability judgment was made in the absence of significant information on the exposure profile and/or health effects.

Qualitative Exposure Rating

QEA Rating = (Health Severity Rating + Exposure Rating) X Certainty Rating

Process	Job	Task (manual)	Agent	Freq.	Dur.	OEL	Exposure Rating	Basis for Exposure Rating	Exposure Judgment	Recommendations
Fabrication	Welder	GTAW Carbon steel	Copper	Var.	2-6 hr.	0.1 mg/m3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean, n=7.	Acceptable	
Fabrication	Welder	GTAW Stainless or carbon steel	Iron oxide	Var.	2-6 hr.	5.0 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean JC < 10% of OEL level, n=14.	Acceptable	
Fabrication	Welder	GTAW Stainless or carbon steel	Manganese	Var.	2-6 hr.	0.02 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean TWA, n=10. Highest TWA: 0.001 mg/m3.	Acceptable	
Fabrication	Welder	GTAW Stainless steel	Chromium	Var.	2-6 hr.	0.5 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations, n=73.	Acceptable	
Fabrication	Welder	GTAW Stainless steel	$Chromium^{+6}$	Var.	2-6 hr.	0.005 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. Highest TWA: 0.04 ug/m3, n=12.	Acceptable	
Fabrication	Welder	GTAW Stainless steel	Nickel insol.	Var.	2-6 hr.	0.2 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean, n=8.	Acceptable	
Fabrication	Welder	GTAW Stainless steel	Fluorides	Var.	2-6 hr.	2.5 mg/m^3 (TWA)	1	Flux-coated wire only. Piping only. Surrogate personal monitoring of SMA welding of carbon steel.	Acceptable	
Fabrication	Welder	GTAW Nickel alloys	Chromium	Var.	2-6 hr.	0.5 mg/m^3 (TWA)	1	Surrogate personal monitoring of GTA welding carbon and stainless steel.	Acceptable	
Fabrication	Welder	GTAW Nickel alloys	Manganese	Var.	2-6 hr.	0.02 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean TWA, n=10. Highest TWA: 0.001 mg/m3.	Acceptable	
Fabrication	Welder	GTAW Nickel alloys	$Chromium^{+6}$	Var.	2-6 hr.	0.005 mg/m^3 (TWA)	1	Surrogate personal monitoring data from 7012 GTAW stainless steel.	Acceptable	
Fabrication	Welder	GTAW Nickel alloys	Nickel insol.	Var.	2-6 hr.	0.2 mg/m^3 (TWA)	1	Surrogate personal monitoring data from 7012 GTAW stainless steel.	Acceptable	
Fabrication	Welder	GTAW Nickel alloys	Copper fume	Var.	2-6 hr.	0.1 mg/m^3 (TWA)	2	Personal monitoring. Data from another location, n=1	Acceptable	

CURRENT CONTROLS: Shop dimensions – ceiling height: ~16 ft., volume: ~52800 ft^3. Local exhaust hoods for all welding tasks. Movable welding curtains.
PPE: safety glasses, welding helmet or goggles with appropriate lens shade, leather/heat-resistant gloves, safety shoes, FR company clothing.
EXPOSURE RATING CRITERIA: 1 -- <10% OEL; 2 – 10 - 50% OEL; 3 – 50 - 100% OEL; 4 -- >100% OEL.

Process	Job	Task (manual)	Agent	Freq.	Dur.	OEL	Exposure Rating	Basis for Exposure Rating	Exposure Judgment	Recommendations
Fabrication	Welder	GTAW Nickel alloys	Cobalt	Var.	2-6 hr.	0.02 mg/m^3 (TWA)	1	Personal monitoring. Data from another location, n=1	Acceptable	
Fabrication	Welder	GTAW Aluminum alloys	Aluminum	Var.	2-6 hr.	1.0 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations, n=11.	Acceptable	
Fabrication	Welder	GTAW Aluminum alloys	Copper fume	Var.	2-6 hr.	0.1 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. Highest TWA: 0.22 ug/m3, n=5.	Acceptable	
Fabrication	Welder	GTAW Aluminum alloys	Ozone	Var.	2-6 hr.	0.1 ppm (TWA)	2	Personal monitoring. Data from other locations, n=3.	Acceptable	
Fabrication	Welder	GTAW Aluminum alloys	Ozone	Var.	2-6 hr.	0.2 ppm $\leq$ 2 hrs.	2	Personal monitoring. Data from other locations, n=5.	Acceptable	
Fabrication	Welder	GTAW Copper	Copper fume	Var.	2-6 hr.	0.1 mg/m^3 (TWA)	2	Personal monitoring. JC data from another location, n=1.	Acceptable	
Fabrication	Welder	GTAW Titanium	Titanium	Var.	2-6 hr.	15.0 mg/m^3 (TWA)	1	Personal monitoring. Data from another location, n=1 (JC < 0.02% of OEL level).	Acceptable	
Fabrication	Welder	GTAW Gal. steel	Iron oxide	Var.	½-2 hr	5.0 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations and data from GTA welding of carbon steel. 95% UCL est. mean JC < 10% of OEL level, n=14.	Acceptable	
Fabrication	Welder	GTAW Gal. steel	Manganese	Var.	½-2 hr	0.02 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations. 95% UCL est. mean TWA, n=10. Highest TWA: 0.001 mg/m3.	Acceptable	
Fabrication	Welder	GTAW Gal. steel	Zinc oxide	Var.	½-2 hr	2.0 mg/m^3 (TWA)	1	Surrogate personal monitoring data from another operation. Highest TWA: 0.06 mg/m3, n=5.	Acceptable	
Fabrication	Welder	Brazing	Fluorides	Var.	½-2 hr	2.5 mg/m^3 (TWA)	2	Personal monitoring. Data from other operations. Highest TWA: < 0.42 mg/m3, n=6	Acceptable	
Fabrication	Welder	Brazing	Silver	Var.	½-2 hr	0.01 mg/m^3 (TWA)	1	Personal monitoring. Data from other locations, n=1. Short duration.	Acceptable	
Fabrication	Welder	Brazing Copper	Copper fume	Var.	½-2 hr	0.1 mg/m^3 (TWA)	1	Personal monitoring. Shop data, n=1. Short duration	Acceptable	

CURRENT CONTROLS: Shop dimensions – ceiling height: ~16 ft., volume: ~52800 ft^3. Local exhaust hoods for all welding tasks. Movable welding curtains.
PPE: safety glasses, welding helmet or goggles with appropriate lens shade, leather/heat-resistant gloves, safety shoes, FR company clothing.
EXPOSURE RATING CRITERIA: 1 -- <10% OEL; 2 – 10 - 50% OEL; 3 – 50 - 100% OEL; 4 -- >100% OEL.

Process	Job	Task (manual)	Agent	Freq.	Dur.	OEL	Exposure Rating	Basis for Exposure Rating	Exposure Judgment	Recommendations
Fabrication	Welder	Various welding, cutting	Visible light	Var.	2-6 hr.	Varies w/ wavelength, intensity, distance	4	References.	Unacceptable; but current controls are appropriate for the hazard	
Fabrication	Welder	Various welding, cutting	Blue light	Var.	2-6 hr.	Varies w/ wavelength, intensity	4	References.	Unacceptable; but current controls are appropriate for the hazard	
Fabrication	Welder	Various welding, cutting	Ultraviolet radiation	Var.	2-6 hr.	Varies w/ wavelength, intensity	4	References.	Unacceptable; but current controls are appropriate for the hazard	

REFERENCES

1. 29 CFR 1910.252. General Requirements for Welding, Cutting, and Brazing.
2. ACGIH. *TLVs and BEIs.* 2005.
3. AIHA. *Welding Health & Safety.* 1984.
4. American Welding Society. S&H Fact Sheet No. 4. Chromium and Nickel in Welding Fume. 1995.
5. Burgess, W.A. *Recognition of Health Hazards in Industry*. 1981.
6. DOE OSH Standards Interpretations Response Line. ID D99-04-009.
7. DOE OSH Standards Interpretations Response Line. ID D95-06-042.
8. Harris, M.K. Welding Health and Safety, A Field Guide for OEHS Professionals. 2002.
9. NIOSH. *Criteria for a Recommended Standard – Welding/Cutting.* 1988.
10. ORNL F&O Welding Procedure Specifications. Sections 18250, 18251, 18350, 18351, and 18450.
11. ORNL Safety Bulletin. Required Protection for Welding, Cutting, or Heating Stainless Steel. 1997.

CURRENT CONTROLS: Shop dimensions – ceiling height: ~16 ft., volume: ~52800 ft^3. Local exhaust hoods for all welding tasks. Movable welding curtains.
PPE: safety glasses, welding helmet or goggles with appropriate lens shade, leather/heat-resistant gloves, safety shoes, FR company clothing.
EXPOSURE RATING CRITERIA: 1 -- <10% OEL; 2 – 10 - 50% OEL; 3 – 50 - 100% OEL; 4 -- >100% OEL.