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ORNL WORK PLAN

Operations, Maintenance and Services

Work Plan Name / Rev: MWP061805 / 0

61805

WORK SCOPE/DESCRIPTION	
Requester (Name/Badge/Division):	White, Scott / 00028700 / X108
Location of work (Bldg/Rm/Other):	7930 / / 3rd Floor
Work Plan Title:	Decontamination of Cell G PaR 2025

Description of Service/Work Needed:

This work plan will address the hazards and controls to perform decontamination of the Cell G PaR reducing contamination/radiation levels to facilitate maintenance and repairs. The Cell G PaR has been removed from service due to a broken boom #2 drive chain and a malfunctioning mast slack cable limit switch. This work plan will be used once the PaR is removed from Cell G, positioned on the PaR Maintenance Stand and confined within a containment tent and primary containment glove bag. The glove bag contains 2 transfer sleeves, 12 glove ports and a drain located at the bottom for decontamination solution removal. A Tygon tube will be connected to the primary containment glove bag drain port. The Tygon tube is part of a solution transfer system consisting of a Rolo-Flex pump, filter and a 275 gallon catch tank. Personnel will perform hand decontamination through glove ports or wet decon methods of the PaR to remove as much contamination as possible. Once acceptable radiation levels are reached, personnel will remove the primary containment glove bag and continue with decontamination as necessary. Area preparations/maintenance using this work plan includes tent repairs, adding or removing contamination barriers/shielding and ventilation system repairs as necessary.

Charge Number, if required:	5179736
Work Plan Grade/Worktype:	1 / D
Author (Name/Badge):	White, Scott / 00028700

File Attachments:

Badge	Name	Attachment Desc	File Name
00028700	White, Scott	QEA for MWP055535 Decontamination of Cell G PaR	MWP055535 Decontamination of Cell G PaR .pdf

INSTRUCTIONS

Prerequisites/Precautions:

-Plan/Schedule work with Facility Management.

-Assure applicable/appropriate access and training requirements are identified and adhered to.

-All work performed in, or in support of, a category 1, 2, or 3 nuclear facility must be conducted in compliance with the nuclear facility Safety Analysis Report and Technical Safety Requirements (TSR).

1. Is it a physical change? No

2. Is it a change to a procedure or program described in the documented safety analysis? Yes

3. Is it a new or revised operation? No

-If any of the above questions were answered Yes, then initiate a USQD or USQD Screening Worksheet in accordance with Unreviewed Safety Question (USQ) process for Nuclear and Facility Safety.

- Verify tent has a minimum of one negative air machine operational at all times.

- Verify that a minimum of two iCAMs are operational. One iCAM will be located in the exit chamber of the tent with the second iCAM within the Contamination Area outside the tent.

- Obtain Radiological Support Services staff review of applicable design packages, work packages or work plans.

- Contact Waste Services Representatives

- Ensure any changes in radiological material inventory are permissible under the facility inventory limitations identified in the Facility Use Agreement, Preliminary Hazard Screening (PHS) document, or Hazard Analysis Document (HAD) and are incorporated into the facility's radiological material inventory tracking for facility hazard categorization. Receipt of radiological material into a facility requires completion of Form ORNL-826 prior to the receipt.

Directions:
-Include documentation in work package which provides traceability of material used.

Post Work Testing:
-Determine post-work testing requirements and acceptance criteria.

Closeout:
-Add step to Closeout section for Facility Management and Task Leader performance of post-work testing.

- Contact Waste Services Representatives

JOB HAZARD EVALUATION	
HAZARDS	PERMITS / CONTROLS
Hoisting and Rigging	ı H&R Equipment is procured: ¡ Special Requirements for Procuring Material/Services exhibit ¡ Using a quality significant review ı Inspections and preventive maintenance is complete: ¡ Initial inspection ¡ Pre-operational inspection ¡ Monthly inspection ¡ Annual/preventive inspection for H&R equipment [Formerly Verification of current certification / inspections for H&R equipment] ı Instructions for Completion of Ordinary Lift Form (ORNL-544, Ordinary Lift Plan) ı Hard hats: Are required when 5/50 Ton is in use. ı Safety shoes ı Qualified personnel
Radiological Work: Decon work will occur in a High Contamination Area, Airborne Radioactivity Area and Radiation Area.	ı Radiological Work Permit (Enter RWP no.): REDC- ı Approved HEPA Vacuum Cleaner ı Dosimetry Monitoring Requirements ı Follow radiological posting, entry control & egress requirements ı Respond to Abnormal Radiological Conditions and Alarms. Radiological alarms include: Continuous Air Monitor (CAM), Area Radiation Monitor (ARM), Electronic Pocket Dosimeter (EPD), Personnel Contamination Monitor (PCM). ı Continuous RCT Coverage : Continuous RCT coverage will be provided while decon efforts are being performed.
Electrical Equipment and Tools	ı Listed by a nationally recognized testing laboratory (NRTL) ı Use GFCI for corded equipment.
Elevated Work: Ladders and rolling ladders will be used.	ı Inspecting Ladders Guide [Step & Fixed] ı Obtain Training - Fixed >10 feet; portable >3 feet ı Buddy System (best management practice only, must select additional controls): Personnel will be stationed at ladders while work is being conducted.
Ergonomic Conditions (Contact Stress, Vibration, Posture, Force, Repetitive Motion): Personnel will be working from rolling and step ladders. Awkward positioning may be required	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)

during decon activities to access PaR surfaces using glovebag ports.	ı PPE: Specify. Will be required per RWP. ı Special Tools (Lifts, etc.): Long handle tools maybe required to assist with decon efforts. ı Diversify activities. ı Worker rotation. ı Frequent breaks.
Heat/Cold Stress: Use of Anti-contamination clothing and respirators.	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 Frequent breaks ı Work performed primarily in conditioned space. Contact IS/IH for evaluation if ambient temperature are elevated at time of task. ı Frequent breaks (As necessary)
Low Clearance	ı Use caution when using ladders near top of tent and PaR.
Manual Material Handling	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 ı Apply hierarchy of controls approach ı Team Lifting (Guideline) 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)
Noise: Operation of pump and negative air machines.	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 Reduce time spent near noise-producing equipment. ı Wearing hearing protection with NRR of 26 or higher if working near equipment generating noise > 90 dbA for > 2 hours.
Obstructed Access/Egress: PaR location on 3rd floor is located inside of tent.	ı Use caution when entering and exiting the work area.
Other Mechanical Hazards (Machine guarding issues, rotating equipment, sharp objects, pinch points, etc.): Rolling poly shielding has potential pinch points. Cutting of glovebags, etc. will be required.	ı Use caution when moving rolling poly shielding due to pinch points, wear material handling gloves as necessary. ı Wear cut resistant gloves over RWP PPE when using cutting tools or if potential for contact with sharp edges.
Chemical/Rec ID 1: Clorox Commercial Solutions Formula 409/81193	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 Gloves: Specify. ı Safety glasses

	ı Use in accordance with SDS.
Chemical/Rec ID 2: Quick Solid/ B-4170	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 Gloves: Specify. ı Safety glasses ı Use in accordance with SDS.
Chemical/Rec ID 3: Instacote CC Doff/RECID L9307	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 Gloves: Specify. ı Safety glasses ı Use in accordance with SDS.
Slips/Trips/Falls	ı Keep pathways clear ı Maintain awareness of potential for slick surfaces and trip hazards. ı Slip-resistant outer shoes covers required when climbing ladders or working near potentially wet/slick surfaces within the tent.
Potential Eye Injury Hazards	ı Safety glasses or equivalent eye protection (i.e. full face APR) required. ı Safety glasses required under PAPR hood.
Overhead Hazards: Personnel working from elevated surfaces on ladders performing decon.	ı Secure tools and supplies on ladders when not in active use. ı Maintain awareness of workers using tools overhead and do not stand or walk in path of potential falling objects/tools.

DOCUMENTATION REVIEW AUTHORIZATION (Approvals are certification of hazards assessment)		
Reviewer/Approver Roles	Signature	Date
Accountable Management (Service Provider, Line, Equipment Owner, or Facility Management)	Caverly, Donald	
Accountable Management (Service Provider, Line, Equipment Owner, or Facility Management)	Weaver, Roger	
IS/IH	Carnahan, Corey	
Nuclear or Facility Engineer	Keener, Douglas	
Project Lead	Lehberger, Tim	
Radiation Protection	Maldonado, Kimberly	
Safety Basis Engineer	Green, Michael A	
Task Leader	Allison Jr, Thomas	
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:

FOR INFORMATION ONLY. WORK RELEASE AND SYSTEM HOLD POINTS		
TASK DESCRIPTION	RESOURCES	DUR
[Hold Point] - Receive approval from the REDC RPO manager that radiological conditions after decontamination are acceptable to remove the glove bag from the PaR.	Project Leader	8

WORK DETAILS - Prerequisites/Precautions			
Hazards	Permits/Controls	Resources	Dur
1) - Ensure an approved USQD is attached and included in this work package prior to beginning work.			
		Project Leader	1
2) - Ensure that tasks performed using this work package have an associated "ready to work" work order assigned and the task is included on or added to the facility POD before beginning work.			
		Project Leader	2
3) - The following is a brief operational history on the Turret Mounted Cell G PaR: The PaR was operational in Cell G for approximately 9 months after initial install in 2017 until boom #2 cable drive failure in 2018. The PaR was surveyed and subsequently removed from the hot cell. The drive system was redesigned and the PaR was decontaminated to enable a drive train refurbishment. The drive system was modified and the PaR was reinstalled in December of 2022. It was operational for about 18 months before boom #2 drive failed again, this time due to a broken drive chain. For reference the following survey data has been included from the Cell G PaR taken in 2020: Five smears were taken on the surfaces of the PaR to be analyzed (11/20/2020). The results ranged from about 7.8 million dpm per 100 cm2 up to 15.6 million dpm per 100 cm2 alpha with the alpha activity being from 99.1% Cf-252 / 0.9% Cm-244E6 to 99.6% Cf-252 / 0.4% Cm-244 (other Cf and Cm isotopes will also be present in much smaller activity amounts). The total surface area of the PaR is about 300 ft2 (Surface Area of 7930 PaR, 04/13/2021). Based on these results the total removable activity on the PaR that might end up in the filter/waste water would be as follows, assuming a conservative 15.6 million dpm (2.6E+05 Bq) over the entire 300 ft2 surface: (300 ft2) x (929.0304 cm2/ft2) x (2.6E+05 Bq) ÷ (100 cm2) ÷ (3.7E+10 Bq/Ci) = ~0.02 Ci (20 mCi) Cf-252 with the Cm-244 activity being less than about 0.0002 Ci (0.2 mCi).			
			3

WORK DETAILS - Directions			
Hazards	Permits/Controls	Resources	Dur
1) - Conduct a pre-job brief using NNFD-FRM-058 "PRE-JOB BRIEF" to identify scope of work, hazards, controls, etc. Include input from all personnel involved in performance of task such as appropriate crafts/technicians and facility operations personnel. The following additional items shall be discussed during pre-job brief. ** Programmed and corrective maintenance SHALL NOT be performed without approval by the Building 7930 Facility Management. ** Impact the work will have on Building 7930 operational status. ** Ensure Building 7930 Facility Management are briefed daily on status of work performed.			

** If unacceptable results are found, immediately place work area in a safe condition and notify Building 7930 Facility management of problems and what actions are necessary for restart.
** Containment tent requirements requirements that must be satisfied before work can start each day. A minimum of one HEPA filtered negative air machine (1,000 CFM) and two iCAMs are required for the tent to be in an operational status.

		ı Project Leader	1

2) - Obtain work start authorization from the Group Lead/Designee at Building 7930.

		ı Project Leader	3

3) - Place all necessary materials needed inside of glove bag to begin wet decon process. Ensure water source for wet decon process is operable and ready for use. Ensure glove bag drain filtering system is intact and ready for use.

Note 1: Water source for wet decon process will be process water from Building 7930. A Graco 390 paint sprayer will be used to apply 409 degreaser/water to PaR during wet decon process.

Note 2: During wet decon process the special made glove bag will contain a drain filtering system. Drain system will consist of: tygon hose connected to bottom of glove bag with inline filter in place to filter contaminants with roto-flex pump in place to pump used decon solution from glove bag to 275 gallon TOTE.

Note 3: For solution containment, the 275 gallon TOTE will be set in a kiddie pool for containment barrier.

Note 4: If in-line filter dose reaches 50 mrem/hr. at 30cm, stop pump and perform filter replacement. Filter micron size should be optimized for flow and decontamination. If flow is too slow then exposure during decontamination could be too high. The solution collected in the 275 gallon tank can be filtered to reduce contaminates at a later date and prior to transfer to Liquid Waste Processing.

Note 5: During usage of ROTO Flex Pump, apply duct tape to tygon hose and attach to 275 Gal. TOTE. Personnel will be stationed at ROTO Flex pump and TOTE while in usage.

		ı Radiological Control Technician ı Pipefitter ı Project Leader ı Technician	4

4) - Perform wet decon method through glove bag. While wet decon method is being performed, inspect glove bag and glove bag drainage system to ensure no leaks are present. Allow RCT's to survey areas as wet decon is in progress to check effectiveness of decon process.

Continue with wet decon process until done. If wet decon is not effective, consult with Facility and RCT Management for further guidance.

		ı Radiological Control Technician ı Project Leader ı Technician	5

[Hold Point] - 5) - **Receive approval from the REDC RPO manager that radiological conditions after decontamination are acceptable to remove the glove bag from the PaR.**

Signature: _____		ı Radiological Control Technician ı Project Leader	8

6) - Once wet decon and/or hand decon through the glove bag methods are deemed complete perform the following: Perform a pre-job briefing with work group to cover the operational changes, RWP changes and new hazards associated with decontamination without the glove bag. Remove glove bag from Cell G PaR.. Note: Absorbent will be added to glove bag to absorb any free standing liquid and provide absorption of any rags, towels, etc. REMOVE GLOVE BAG AS FOLLOWS: Detach glove bag from top of PaR and fold bag inside of itself to keep contamination contained as much as possible until bag is removed. Continue to fold outside in until the contaminated inside of the bag is no longer exposed. Once bag removal is complete, allow RCT's to survey floor, tent, etc. for any loose contamination. If contamination is present, decontaminate the area at the discretion of the RCT's.			
		• Project Leader • Technician	6
7) - Continue with PaR decon efforts as needed.			
		• Radiological Control Technician • Project Leader • Technician	8
WORK DETAILS - Post Work Testing			
Hazards	Permits/Controls	Resources	Dur
1) - RCT's are to perform a full survey of PaR, Tent area and floor inside/outside of tent.			
		• Radiological Control Technician	1
WORK DETAILS - Closeout			
Hazards	Permits/Controls	Resources	Dur
1) - Notify Building 7930 Facility Management when work is complete.			
		• Project Leader	1
2) - Conduct post-job brief as required and document any lessons learned during performance of tasks on NNFD-FRM-058 "Post-Job-Review".			
		• Project Leader	2
3) - Clean work area and dispose of waste as per REDC Waste Management project lead guidance.			
		• Waste Management Task Lead • Project Leader	3

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PRE-JOB SAFETY REVIEW GUIDE

ID: 61805

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: Heat Stress. Discuss controls incorporated into *Work Control* to assure EA is conducted in the future: Work performed primarily in conditioned space. Contact IS/IH for evaluation if ambient temperatures are elevated at time of task

Process/Job/Task: (SEG/SET Name) MWP055535 Decontamination of Cell G PaR

Work Description: MWP055535 Decontamination of Cell G PaR

Facility #: 7930 **Room/Lab/Shop #:** Facility

Organization: NNFD **RSS/Work Plan #:** MWP055535 Decontamination of Cell G PaR

Agents and Control Information

	Process/Job/Task	Rec ID	Agent	Quantity or Magnitude	[1]Potential Routes of Entry	Primary Exposure Forms	Frequency of Exposure	Duration of Exposure per Exposure Event	[2]Engineering and Administrative Controls	*OEL	Health Severity Rating 1-4	Exposure Rating 1-4	Certainty Rating 1-3	[3]QEA Rating 1-24	[4]Exposure Decision
1	Decontamination activities,	N/A	Ergonomic Conditions	NA	Other	Other	Variable	1/2 - 2 hours	P, T	N/A	3	2	1	5	Acceptable (2 - 7)
2	Spray application of CC Doff fixative	L9307	None Listed	< 1 L	Inh, Ing	Mist	Variable	< 1/2 hour	P, T, GV, Other LEV (Tent enclosure with HEPA Exhaust)	N/A	2	2	1	4	Acceptable (2 - 7)
3	Decontamination of surfaces with Formula 409	81193	Ethylene Glycol Monobutyl Ether	<2 L	Inh, S	Mist	Daily	1/2 - 2 hours	P, T, GV, Other LEV (Tent enclosure with HEPA Exhaust)	20 ppm	2	2	1	4	Acceptable (2 - 7)
4	Use of Quik Solid	B1470	Acrylic Acid	8 oz	Inh, Ing	Particulate	Variable	1/2 - 2 hours	P, T, GV, Other LEV (Tent enclosure with HEPA Exhaust)	2 ppm	2	3	1	5	Acceptable (2 - 7)
5	Incidental lifting of tools and equipment	N/A	Manual Material Handling	< 50 lbs	Other	Other	Variable	Variable	P, T	N/A	3	2	1	5	Acceptable (2 - 7)
6	Noise from pumps and HEPA venitilation equipment	N/A	Noise	< 90 dbA	Other	Other	Variable	< 1/2 hour	P, T	85 dbA-TWA	2	2	1	4	Acceptable (2 - 7)
7															
8															
9															
10															

1. Routes of entry codes: Inh – Inhalation, P – Penetration, Ing – Ingestion, S – Splash; A – Absorption **2. 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;

3. QEA Rating = (Health Severity Rating + Exposure Rating) x Certainty Rating; 4. 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	Worker rotation and use of long handled tools when performing decon activities. Use of knee pads or cushions with any prolonged work associated with kneeling.				
2	YES	Significant exposure is not anticipated due to limited volume of product in use and ventilation in the work area (LEV attached to tent). Respiratory protection worn per RWP.				
3	YES	Significant exposure is not anticipated due to limited volume of product in use and ventilation in the work area (LEV attached to tent). Respiratory protection worn per RWP.				

Qualitative Exposure Assessment – Multiple Hazard Form

4	YES	Significant exposure is not anticipated due to limited volume of product in use and ventilation in the work area (LEV attached to tent). Respiratory protection worn per RWP.	_____	_____	___	
5	YES	Incidental lifting of tools and equipmen.Hiercachy of controls will be followed.Lifting aides used as necessary. 30-50-30 guideline will be followed.t	_____	_____	___	
6	YES	Noise-producing equipment is not adjacent to worker location. Time spent in close proximity to noise sources < 2 hr.	_____	_____	___	
7	___		_____	_____	___	
8	___		_____	_____	___	
9	___		_____	_____	___	
10	___		_____	_____	___	

Qualified H&S Professional: Lori Manis, MPH **Date:** 4/8/2021

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