	<b>Risk Tables Description</b>	Baseline Risk	Residual Risk
2.1	Radiological – Onsite-1 Facility Worker	R: III	R: IV
2.2	Radiological – Onsite-2 Co-located Worker	R: III	R: IV
2.3	Radiological – MOI Offsite	R: IV	R: IV
2.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
2.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
2.6	Toxic Materials – MOI Offsite	R: *	R: *
2.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *
2.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *
2.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
2.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *
2.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *
2.12	Electrical Energy – MOI Offsite	R: *	R: *
2.13	Thermal Energy – Onsite-1 Facility Worker	<u>R: *</u>	<u>R: *</u>
2.14	Thermal Energy – Onsite-2 Co-located Worker	<u>R: *</u>	<u>R: *</u>
2.15	Thermal Energy – MOI Offsite	<u>R: *</u>	<del>R:</del>
2.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
2.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
2.18	Kinetic Energy – MOI Offsite	R: *	R: *
2.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
2.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
2.21	Potential Energy – MOI Offsite	R: *	R: *
2.22	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
2.23	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
2.24	Other Hazards – MOI Offsite	R: *	R: *
2.25	Environmental Hazards	R: *	R: *

#### Table 2. Summary of Baseline and Residual Risks – Radiation Analysis Facility (RAF)

\* This hazard has been evaluated within the common Risk Matrix table included in SAD Section I Chapter 04 *Safety Analysis*. Work in the specified areas involving this hazard implements the controls specified in the common Risk Matrix table. No unique controls are in use. **NOTE:** 

Per DOE-HDBK-1163-2020, Appendix C, "Risk Assessment Methodology":

"Events with an unmitigated risk value of III or IV would not require additional control assignments to provide reasonable assurance of adequate protection. Whereas, for events with an unmitigated risk value of I or II, controls would need to be assigned to either reduce the likelihood or the consequence, and therefore the overall mitigated risk. Generally, preventive controls are applied prior to a loss event – reflecting a likelihood reduction and mitigative controls are applied after a loss event – reflecting a consequence reduction. Each control is credited for a single "bin drop" either in likelihood or consequence; not both. Following a standard hierarchy of controls, controls are applied until the residual risk is acceptable – reflecting a mitigated risk value of III or IV. After controls are credited, events with a remaining unacceptable residual risk (i.e., I or II) are candidates for additional analyses and additional controls, often quantitative in nature." For Fermilab, these controls for accelerator-specific hazards are identified as Credited Controls and further summarized in the Accelerator Safety Envelope (ASE).

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# Table 2.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual	Hazard: Presence of activated	L: A	P: SOPs provides the process for workers to follow to avoid exposure to	L: EU
activation	samples for analysis.	C: L	residual radiation in samples.	C: N
		R: III	P: Only trained workers allowed to perform sample analysis at RAF (over)	R: IV
			M: RWPs provide work controls to mitigate exposure of workers to	
			residual activation.	
			M: postings inform workers of potential hazard to mitigate exposure to	
			residual activation.	
			M: dosimetry (down) provides an ongoing method to measure exposure	
			buildup allowing workers the opportunity to mitigate their exposure.	
Radioactive	Hazard: Presence of analysis	L: A	P: SOPs provides the process for workers to follow to generate radioactive	L:EU
waste	materials and containers that are	C: N	wastes while avoid exposure to it,	C: N
	designated as radioactive waste after	R: IV	P: Only trained workers allowed to perform sample analysis at RAF (over)	R: IV
	preparation or analysis.		M: RWPs provide work controls to mitigate exposure of workers to	
			radioactive waste.	
			M: postings inform workers of potential hazard to mitigate exposure to	
			radioactive waste.	
			M: dosimetry (down) provides an ongoing method to measure exposure	
			buildup allowing workers the opportunity to mitigate their exposure.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Contamination	Hazard: Contamination from spills or inadvertent transfer of material from analytical samples.	L: A C: N R: IV	<ul> <li>P: SOPs provide the process for workers to follow during analytical work to prevent contamination transfer to themselves,</li> <li>P: Only trained workers allowed to perform sample analysis at RAF (over)</li> <li>M: RWPs provide work controls to mitigate exposure of workers to contamination.</li> <li>M:PPE mitigates to movement of contamination between objects and workers.</li> <li>M: postings inform workers of potential hazard to mitigate exposure to radioactive waste.</li> </ul>	L:EU C: N R: IV
<sup>7</sup> Be	Hazard: Potential radiation exposure to 7Be (uptake/committed dose).	L: A C: N R: IV	<ul> <li>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure.</li> <li>Not Applicable. No prevention or mitigation is required. <sup>7</sup>Be isn't hazardous in this pattern of use by facility.</li> </ul>	L: A C: N R: IV
Radioactive Sources	Hazard: Presence of check sources for detector calibration.	L: A C: L R: III	<ul> <li>P: SOPs provides the process for workers to follow to avoid direct exposure to radioactive sources,</li> <li>P: Only trained workers allowed to perform sample analysis at RAF (over)</li> <li>M: RWPs provide the work controls to mitigate radiation exposure by limiting time, distance and shielding.</li> <li>M: postings inform workers of potential hazard so they can actively mitigate exposure to radioactive sources.</li> <li>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure.</li> </ul>	L: EU C: N R: IV

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	nsequence (C, of event)/ye	ear   Risk (R, Qualitative H	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	t) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	<b>II</b> = situation (eve	nt) of concern		-	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	ent) of minor concern	es	Н	Ι	Ι	Π	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (evolution)	= situation (event) of minimal concern			II	II	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	edu	т	Ш	Ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem	$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L	III		IV	IV		
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	100 rem > $\mathbf{C} \ge 25$ rem	100 rem > $\mathbf{C} \ge 25$ rem		Ν	IV	IV	IV	IV		
Acronyms MOL – Maximally, avraged Officite Individual	L	5 rem $>$ C	25 rem > C	25 rem > C								
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$	5  rem > C	5  rem > C								

# Table 2.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual	Hazard: Presence of activated	L: A	P: SOPs provide the process for co-located workers to follow to avoid	L: EU
activation	samples for analysis.	C: N	samples with residual activation.,	C: N
		R: III	<ul> <li>P: Only trained workers allowed to perform sample analysis at RAF (over)</li> <li>M: RWPs provide work controls with prohibit co-located workers from working with samples containing residual activation.</li> <li>M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to residual activation.</li> <li>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure.</li> </ul>	R: IV
Radioactive	Hazard: Presence of analysis	L: U	P: SOPs provides the process for co-located workers to follow to avoid	L:BEU
waste	materials and containers that are	C: N	radioactive wastes staging areas in the facility,	C: N
	designated as radioactive waste after preparation or analysis.	R: IV	<ul> <li>P: Only trained workers allowed to perform sample analysis at RAF (over)</li> <li>M: RWPs provide work controls to mitigate exposure of co-located workers to radioactive waste.</li> <li>M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to radioactive waste.</li> <li>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure.</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Contamination	Hazard: Contamination from spills or	L: U	P: SOPs,	L:BEU
	inadvertent transfer of material from	C: N	P: Only trained workers allowed to perform sample analysis at RAF (over)	C: N
	analytical samples.	R: IV	M: RWPs provide work controls to mitigate exposure of workers to contamination.	R: IV
			M: posting postings inform co-located workers of potential hazard so they can actively mitigate exposure to contamination.	
			M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure.	
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: A	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't	L: A
	to 7Be (uptake/committed dose).	C: N	hazardous in this pattern of use by facility.	C: N
		R: IV		R: IV
Radioactive	Hazard: Presence of check sources for	L: A	P: SOPs provide the process for co-located workers to follow to avoid	L: EU
Sources	detector calibration.	C: L	radioactive sources in the workplace,	C: N
		R: III	P: Only trained workers allowed to perform sample analysis at RAF (over) M: RWPs provide work controls to mitigate exposure of co-located workers to contamination.	R: IV
			M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to radioactive sources.	
			M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure.	

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	nsequence (C, of event)/ye	ear Risk (R, Qualitative )	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation}$ (eve	ent) of concern		-	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	ent) of minor concern	es	Н	Ι	Ι	Π	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	V = situation (event) of minimal concern			II	II	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т	Ш	Ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem	$C \ge 100 \text{ rem}$	<b>C</b> ≥ 100 rem	ons	L	III		IV	IV		
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	100 rem > $\mathbf{C} \ge 25$ rem	100 rem > $\mathbf{C} \ge 25$ rem		Ν	IV	IV	IV	IV		
Acronyms MOL – Maximally, avraged Officite Individual	L	5 rem $>$ C	25 rem > C	25 rem > C								
<b>MOI</b> = Maximally-exposed Offsite Individual <b>rem</b> = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$	5  rem > C	5  rem > C								

#### Table 2.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual	Hazard: Presence of activated	L: EU	P: RAF is a locked facility, preventing access by members of the public.	L: BEU
activation	samples for analysis.	C: N		C: N
		R: IV		R: IV
Radioactive	Hazard: Presence of analysis	L: EU	P: RAF is a locked facility, preventing access by members of the public.	L:BEU
waste	materials and containers that are	C: N		C: N
	designated as radioactive waste after preparation or analysis.	R: IV		R: IV
Contamination	Hazard: Contamination from spills or inadvertent transfer of material from analytical samples.	L: EU C: N R: IV	P: RAF is a locked facility, preventing access by members of the public.	L:BEU C: N R: IV
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: EU	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't	L: BEU
	to 7Be (uptake/committed dose).	C: N	hazardous in this pattern of use by facility.	C: N
		R: IV		R: IV
Radioactive	Hazard: Presence of activated	L: UE	P: RAF is a locked facility, preventing access by members of the public.	L: BEU
Sources	samples for analysis.	C: L		C: L
		R: IV		R: IV

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	nsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (ev	ent) of concern		-	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (e	vent) of minor concern	es	Н	Ι	Ι	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	<b>IV</b> = situation (e	situation (event) of minimal concern			Π	Π	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	edu	т	Ш	ш	TV.	- TV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge 25.0$ rem	$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L	111	- 111	IV	IV		
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	100 rem > $\mathbf{C} \ge 25$ rem	100 rem > C ≥ 25 rem		Ν	IV	IV	IV	IV		
Acronyms MOL – Maximally, averaged Officite Individual	L	5 rem $>$ C	25 rem > C	25 rem > C								
<b>MOI</b> = Maximally-exposed Offsite Individual <b>rem</b> = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$	5  rem > C	5 rem > C								

# Table 2.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead dust during manual handling of un- encased lead bricks, lead shot, and lead sheets.	L: C: R:	See Section I Chapter 04	L: C: R:
Liquid Scintillator Oil	Hazard: Potential exposure to liquid scintillator oil during sample preparation or analysis.	L: A C:L R: III	<ul><li>P: SOPs require samples to be prepared in a fume hood.</li><li>P: Only trained workers allowed to perform sample analysis at RAF</li><li>M: SOPs require gloves when preparing LSC samples.</li></ul>	L: EU C: N R: IV

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.														
Likelihood (L, of event)/year	C	onsequence (C, of event	)/year	Risk (R, Qualitative	, Qualitative Ranking)				Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern			Likelihood						
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (eve	ent) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (ev	vent) of minor concern	es	Η	Ι	Ι	Π	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	eduences	М	Π	II	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т	TTT	TT	<b>T</b> 7	13.7			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge PAC-2$		$C \ge PAC-3$	C≥IDLH	ons	L	III	III	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	PA	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		Ν	IV	IV	IV	IV			
Acronyms IDLH = Immediately Dangerous to Life and Health	L	$\frac{PAC-1 > C}{PAC-1 > C}$		$\frac{1000 \text{ C}}{\text{PAC-2} > \text{C}}$	$\frac{12 \text{ LM}^2 + 0 \text{ LM}^2 + 0 \text{ LM}^2}{\text{PEL or TLV}_c > C}$	-								
MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV <sub>c</sub> = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level									

#### Table 2.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead dust during manual handling of un- encased lead bricks, lead shot, and lead sheets.	L: C: R:I	See Section I Chapter 04.	L: C: R:
Liquid Scintillator Oil	Hazard: N/A	L: U C: L R: III	<ul><li>P: SOPs require samples to be prepared in a fume hood.</li><li>P: Only trained workers allowed to perform sample analysis at RAF</li><li>M: SOPs require gloves when preparing LSC samples.</li></ul>	L: BEU C: N R: IV

Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Risk (R, Qualitative Ranking)			x			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (ev	vent) of minor concern	ces	Η	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	nenc	М	II	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	-				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \ge \mathbf{PAC-2}$		$\mathbf{C} \ge \mathbf{PAC-3}$	C≥IDLH	ons	L	III	III	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)	м	$PAC-2 > C \ge PAC-1$	PA	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	Co	Ν	IV	IV	IV	IV
Acronyms	L	PAC-1 > C	11	$\frac{RC-2 > C}{PAC-2 > C}$	$\frac{10 \text{ E} \text{ I }       \text$						
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level						
$TLV_c$ = Threshold Limit Value (ceiling)											

#### Table 2.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead dust during manual handling of un- encased lead bricks.	L: C: R:	See Section I Chapter 04	L: C: R:
Liquid Scintillator Oil	Hazard: Potential exposure.	L: EU C: L R: IV	<ul><li>P: Public screening at the Fermilab site boundary.</li><li>P: RAF is a locked facility which does not allow unaccompanied public access.</li></ul>	L: BEU C: L R: IV

C-1	Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
C	onsequence (C, of event	)/year	Risk (R, Qualitative	Qualitative Ranking)			X						
	$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Like	lihood				
	$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (evolution)	ent) of concern			Α	U	EU	BEU			
	$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	se	Η	Ι	Ι	II	III			
	N = Negligible	N = Negligible		vent) of minimal concern	enc	М	II	П	III	IV			
С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edu	т	тт	ш	πı	RV.			
Н	$C \ge PAC-2$		$C \ge PAC-3$	C ≥ IDLH	suo	L	ш	ш	IV	IV			
М	-	PA		$IDLH > C > PFL or TLV_{2}$	U U	Ν	IV	IV	IV	IV			
L	PAC-1 > C	17	$\frac{1000 \text{ PAC-2} > C}{\text{PAC-2} > C}$	$PEL \text{ or } TLV_c > C$			•						
N	Consequences less than those for Low Consequence Level			Consequences less than those for Low Consequence Level									
	C C	Consequence (C, of event) $H = High$ $M = Moderate$ $L = Low$ $N = Negligible$ COffsite (MOI)H $C \ge PAC-2$ MPAC-2 > C $\ge$ PAC-1LPAC-1 > CNConsequences lessthan those for Low	Consequence (C, of event)/year $H = High$ $M = Moderate$ $L = Low$ $N = Negligible$ COffsite (MOI)H $C \ge PAC-2$ MPAC-2 > C \ge PAC-1PPAC-1 > CNConsequences lessConsequences lessthan those for Lowthose	Consequence (C, of event)/year H = High M = Moderate L = Low N = NegligibleRisk (R, Qualitative I = situation (event II = situation (event III = situation (event 	Consequence (C, of event)/year H = High M = Moderate L = Low N = NegligibleRisk (R, Qualitative Ranking) I = situation (event) of major concern II = situation (event) of concern III = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concernCOffsite (MOI)Onsite-2 (co-located worker)Onsite-1 (facility worker)H $C \ge PAC-2$ $C \ge PAC-3$ $C \ge IDLH$ MPAC-2 > C $\ge PAC-1$ PAC-3 > C $\ge PAC-2$ IDLH > C $\ge PEL$ or $TLV_c$ LPAC-1 > CPAC-2 > CPEL or $TLV_c > C$ NConsequences less than those for LowConsequences less than those for LowConsequences less than those for Low	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			

# Table 2.7 Flammable and Combustible Materials – Onsite -1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard: Smoke inhalation and or	L: C:	See Section I Chapter 04	L: C:
materials (cables, Boxes,	burns from a fire involving combustible materials.	R:		R:
Paper, wood cribbing, etc.)	combusitore materials.			
Flammable	Hazard: Smoke inhalation and or	L:	See Section I Chapter 04	L:
Materials	burns from a fire caused by	C:		C:
(Flammable gas,	flammable materials resulting in	R:		R:
cleaning	smoke inhalation or burns.			
materials, etc.)				

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Consec	quence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				-	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV
$\mathbf{P}$ = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	L	III	ш	IV	1V
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects $> C$	hospitalization > C	hospitalization > C						
	Ν	Consequences less	Consequences less than	Consequences less than						
		than those for Low the	nose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible materials (cables, Boxes, Paper, wood cribbing, etc.)	Hazard: Smoke inhalation and or burns from a fire involving combustible materials.	L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	Hazard: Smoke inhalation and or burns from a fire caused by flammable materials resulting in smoke inhalation or burns.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Consec	quence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				-	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV
$\mathbf{P}$ = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	IV	1V
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$\mathbf{C} \ge $ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects $> C$	hospitalization > C	hospitalization > C						
	Ν	Consequences less	Consequences less than	Consequences less than						
		than those for Low the	nose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

#### Table 2.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible materials (cables, Boxes, Paper, wood cribbing, etc.)	Hazard: Smoke inhalation and or burns from a fire involving combustible materials.	L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	Hazard: Smoke inhalation and or burns from a fire caused by flammable materials resulting in smoke inhalation or burns.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Consec	quence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				-	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	IV	1V
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects $> C$	hospitalization > C	hospitalization > C						
	Ν	Consequences less	Consequences less than	Consequences less than						
		than those for Low the	nose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

# Table 2.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage Exposure	Hazard: Shock hazard from bias greater than 50V.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1	, "Е	xample Qualitative Cons	sequenc	e Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	$\mathbf{L} = \mathbf{Low}$		vent) of minor concern	es	Η	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		<b>IV</b> = situation (ev	vent) of minimal concern	enc	М	П	II	III	IV
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (co		Onsite-1 (facility worker)	Consequences	T	ш	Ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	$\mathbf{C} \geq$ Irreversible,	$\mathbf{C} \ge \Pr{\mathbf{C}}$	ompt worker fatality	$C \ge Prompt worker$	suo	L	m		IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,			fatality or acute injury that	0	Ν	IV	IV	IV	IV
Acronyms		or symptoms which		nmediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	Μ	$C \ge Mild$ , transient	$\mathbf{C} \ge \mathbf{S}$	Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	immed	diate loss of life no	immediate loss of life no						
			perm	anent disabilities;	permanent disabilities;						
			hospit	talization required.	hospitalization required.						
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no						
		adverse effects $> C$	hos	spitalization > C	hospitalization $> C$						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

# Table 2.11 Electrical Energy Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage Exposure	Hazard: Shock hazard from bias greater than 50V.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year   Risk (R, Qualitative	e Ranking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (ev	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$	II = situation (e)	$\mathbf{II} = \text{situation (event) of concern}$			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	$\mathbf{III} = \text{situation} (\mathbf{e})$	event) of minor concern	ses	Н	Ι	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible	IV = situation (e)	event) of minimal concern	enc	М	II	II	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	III	Ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq $ Irreversible,	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	Ons	L	m	- 111	11	1 V		
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	Ν	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective										
		action.										
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$\mathbf{C} \ge$ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects $> C$	hospitalization > C	hospitalization $> C$								
	Ν	Consequences less	Consequences less than	Consequences less than								
		than those for Low	those for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

# Table 2.12 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage Exposure	<i>Hazard:</i> Shock hazard from bias greater than 50V.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.														
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	/year Risk	(R, Qualitative	Ranking)	Risk Matrix								
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	1	I = situation (even	nt) of major concern				-	lihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$	]	$\mathbf{II} = \text{situation} (\text{evolution})$	ent) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	se	Η	Ι	Ι	Π	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	]	IV = situation (ev	vent) of minimal concern	enc	М	П	II	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-l	located worker)	Onsite-1 (facility worker)	Consequences	T	ш	ш	IV	IV			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge$ Irreversible,	$\mathbf{C} \ge \mathbf{Prompt}$	worker fatality	$C \ge Prompt worker$	ons	L	III	III	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,		injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV			
Acronyms		or symptoms which		iately life-	is immediately life-									
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		or permanently	threatening or									
		individual's ability to	disa	abling.	permanently disabling.									
		take protective		C										
		action.												
	Μ	$C \ge Mild$ , transient	$\mathbf{C} \ge \text{Serio}$	us injury, no	$C \ge$ Serious injury, no									
		adverse effects.	immediate	loss of life no	immediate loss of life no									
			permanen	t disabilities;	permanent disabilities;									
			hospitaliza	tion required.	hospitalization required.									
	L	Mild, transient	Minor i	njuries; no	Minor injuries; no									
		adverse effects > C	hospital	ization > C	hospitalization $> C$									
	Ν	Consequences less	Conseque	nces less than	Consequences less than									
		than those for Low	those for Lo	w Consequence	those for Low									
		Consequence Level	L	level	Consequence Level									

# Table 2.13 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Cryogenic Liquids	Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	$\mathbf{I}$ = situation (event) of major concern				-	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV	
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	Ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	1V	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low the	nose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.14 Thermal Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Cryogenic Liquids	Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	= situation (event) of major concern				-	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	IV	1V	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low the	nose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.15 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Cryogenic Liquids	Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix				
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	situation (event) of major concern				-	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation} (\text{ev})$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , C	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	L	III	ш	IV	1V	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization $> C$							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low th	ose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.16 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Mobile Shielding	Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (even	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV		
Control(s) Type	С	Offsite (MOI) 0	Insite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	Ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	L	III		IV	IV		
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-						<u> </u>		
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	C C									
		action.										
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization $> C$								
	Ν	Consequences less	Consequences less than	Consequences less than								
		than those for Low the	nose for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

# Table 2.17 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Mobile Shielding	Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equen	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	С	onsequence (C, of event)/y	year	Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (evolution)			-	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (ev	vent) of minor concern	es	Η	Ι	Ι	Π	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	Π	Π	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	L	III	Ш	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	H	other serious effects,	or	Prompt worker fatality acute injury that is	$C \ge$ Prompt worker fatality or acute injury that	Con	N	IV	IV	IV	IV		
Acronyms MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.		mmediately life- ening or permanently disabling.	is immediately life- threatening or permanently disabling.								
	Μ	C ≥ Mild, transient adverse effects.	imm per	Serious injury, no ediate loss of life no manent disabilities; bitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.								
	L	Mild, transient adverse effects > C		/linor injuries; no ospitalization > C	Minor injuries; no hospitalization > C								

#### Table 2.18 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Mobile Shielding	Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	С	onsequence (C, of event)/y	year	Risk (R, Qualitative	Ranking)	Risk	Matr	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	-	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (evolution)	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	ces	Η	Ι	Ι	Π	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	en	М	Π	II	III	IV
Control(s) Type	С			e-2 (co-located worker)	Onsite-1 (facility worker)	nbəsı	L	III	III	IV	IV
<ul> <li>P = Preventive (reduce event occurrence likelihood)</li> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>	Η	other serious effects, or symptoms which	or i	Prompt worker fatality acute injury that is mmediately life- tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Com	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	imm per hosp N	≥ Serious injury, no dediate loss of life no manent disabilities; <u>pitalization required.</u> Minor injuries; no ospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C						

# Table 2.19 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Compressed Gasses	Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.	L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum Pumps	Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix				
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				-	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV	
$\mathbf{P}$ = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	L	III	ш	IV	1V	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	М	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low the	nose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.20 Potential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Compressed Gasses	Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.	L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum Pumps	Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	x						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern									
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	ent) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV			
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	L	III	ш	IV	1V			
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV			
Acronyms		or symptoms which	immediately life-	is immediately life-									
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or									
		individual's ability to	disabling.	permanently disabling.									
		take protective											
		action.											
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no									
		adverse effects.	immediate loss of life no	immediate loss of life no									
			permanent disabilities;	permanent disabilities;									
			hospitalization required.	hospitalization required.									
	L	Mild, transient	Minor injuries; no	Minor injuries; no									
		adverse effects $> C$	hospitalization > C	hospitalization > C									
	Ν	Consequences less	Consequences less than	Consequences less than									
		than those for Low the	nose for Low Consequence	those for Low									
		Consequence Level	Level	Consequence Level									

# Table 2.21 Potential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Compressed Gasses	Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.	L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum Pumps	Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix				
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				lihood	-		
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation} (\text{ev})$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	TTT	тт	TV.	TV.	
$\mathbf{P}$ = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , C	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	III	IV	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low th	ose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.22 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Ergonomics	Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix				
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				lihood			
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation} (\text{ev})$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	Ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$\mathbf{C} \geq \text{Prompt worker}$	suo	L	III	ш	IV	1V	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$\mathbf{C} \ge $ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low the	nose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

#### Table 2.23 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Ergonomics	Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Risk (R, Qualitative Ranking)		Risk Matrix					
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	$\mathbf{I}$ = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation} (\text{ev})$	$\mathbf{II} = \text{situation (event) of concern}$				U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	Ш	IV	
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , C	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	IV	1V	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	М	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low th	ose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

#### Table 2.24 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Ergonomics	Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.	L: BEU C: N R: IV	NA.	L: BEU C: N R: IV

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ear Risk (R, Qualitative	Risk (R, Qualitative Ranking)		Risk Matrix					
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	II = situation (evolution)	$\mathbf{II} = \text{situation (event) of concern}$				U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV	
Control(s) Type	С	Offsite (MOI) 0	onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	ш	Ш	IV	IV	
$\mathbf{P}$ = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	suo	L	III	ш	1V	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual			hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	Μ	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects $> C$	hospitalization > C	hospitalization > C							
	Ν	Consequences less	Consequences less than	Consequences less than							
		than those for Low the	nose for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

#### **Table 2.25 Environmental**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Airborne	<ul> <li>Hazard:</li> <li>Airborne release of radionuclides beyond permitted limits.</li> <li>Discharge of chemicals into onsite surface waters beyond permitted limits.</li> </ul>	L: C: R:	See Section I Chapter 04	L: C: <b>R:</b>
Water	<ul> <li>Hazard:</li> <li>Discharge of radionuclides into onsite surface waters beyond permitted limits.</li> <li>Discharge of chemicals into onsite surface waters beyond permitted limits.</li> </ul>	L: C: R:	See Section I Chapter 04	L: C: <b>R:</b>

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Soil	<ul> <li>Hazard:</li> <li>Discharge of radionuclides beyond allowable concentrations of radionuclides beyond calculated Fermilab limits.</li> <li>Discharge of chemicals into onsite soils beyond permitted limits.</li> </ul>	L: C: R:	See Section I Chapter 04	L: C: <b>R:</b>