	<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: N/A	R: N/A
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: N/A	R: N/A
2.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *
2.8	Flammable & Combustible Materials – Onsite-2 Co-located	R: *	R: *
	worker		
2.9	Flammable & Combustible Materials – MOI Offsite	R: N/A	R: N/A
2.10	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
2.11	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
2.12	Thermal Energy – MOI Offsite	R: N/A	R: N/A
2.13	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
2.14	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
2.15	Kinetic Energy – MOI Offsite	R: N/A	R: N/A
2.16	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
2.17	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
2.18	Potential Energy – MOI Offsite	R: N/A	R: N/A
2.19	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
2.20	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
2.21	Other Hazards – MOI Offsite	R: N/A	R: N/A
2.22	Environmental Hazards	R: *	R: *

# Table 2. Summary of Baseline and Residual Risks – Waste Handling Facility

\* 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; 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: Worker receiving elevated	L: A	P – Items are surveyed prior to storage locations being identified prevents	L:EU		
activation	dose from items with residual activations.	C: L R: III	<ul> <li>elevated worker dose from residual activation.</li> <li>P – The workers are trained RCT's, and training and awareness prevents them from receiving elevated doses from waste items</li> <li>M – Do not have any items in storage &gt; 25 rem, which mitigates the potential dose to workers.</li> <li>M – The workers practice ALARA, which mitigates potential dose to workers.</li> </ul>	C: N R: IV		
Radioactive waste	Hazard: Worker receiving elevated dose from radioactive waste.	L: A C: L R: III	<ul> <li>P – Items are surveyed prior to storage locations being identified to prevent elevated worker dose from residual activation.</li> <li>P – The workers are trained RCT's and training and awareness prevents them from receiving elevated doses from waste items.</li> <li>M – Do not have any items in storage &gt; 25 rem, which mitigates the potential dose to workers.</li> <li>M – The workers practice ALARA, which mitigates potential dose to workers.</li> </ul>	L:EU C: N R: IV		
Contamination	Hazard: Workers encountering contamination managing waste.	L: A C: L R: III	<ul> <li>P – Waste is packaged prior to receipt at the LLWHB or BY by the waste generators. This prevents waste facility workers from interacting with waste forms directly.</li> <li>M – Quarterly contamination wipes are taken at both locations, and these results are used to mitigate the potential spread of contamination throughout various areas.</li> <li>M – The workers practice ALARA, which mitigates potential spread of contamination among workers.</li> </ul>	L: U C: N R: IV		

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Radioactive	Hazard: Workers receiving elevated	L: A	P – Source technicians receive special training for management of sources	L: U
Sources	dose managing sources.	C: L	to prevent exposure to radioactive sources.	
		R: III	M – Semi-annual wipes are taken to ensure leak free status of source capsules is maintained, thereby mitigating exposure from leaky sources. M – Source technicians wear special dosimetry while managing sources, to monitor exposure and minimize it by applying ALARA principles.	R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative Ranking)			Matri				
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (even	$\mathbf{II} = \text{situation (event) of concern}$			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (eve	ent) of minor concern	es	Н	Ι	Ι	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	N = Negligible		ent) of minimal concern	nenc	М	II	Π	III	IV
Control(s) Type	С	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nbə	Ŧ				
<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	III	III	IV	IV
$\mathbf{M}$ = Mitigative (reduces event consequences)	Μ	$25.0 \text{ rem} > \mathbb{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbb{C} \ge 25 \text{ rem}$	100 rem > $\mathbf{C} \ge 25$ rem	0	Ν	IV	IV	IV	IV
ronyms		5 rem $>$ C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	5  rem > C	1					

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

Hazard	(without controls)			
Residual activation	Hazard: Worker receiving elevated dose from items with residual activations.	L: A C: L R: III	<ul> <li>P – Items are surveyed prior to storage locations being identified to prevent elevated co-located worker dose from residual activation.</li> <li>P – The workers are trained RCT's and training and awareness prevents potential for receiving elevated doses from waste items.</li> <li>M – Do not have any items in storage &gt; 25 rem</li> <li>M – The co-located workers practice ALARA</li> </ul>	L: EU C: N R: IV
Radioactive waste	Hazard: Worker receiving elevated dose from radioactive waste.	L: A C: L R: III	<ul> <li>P – Items are surveyed prior to storage locations being identified preventing elevated co-located worker doses from radioactive waste.</li> <li>P – The workers are trained RCT's</li> <li>M – Do not have any items in storage &gt; 25 rem, which mitigates potential dose to co-located workers.</li> <li>M – The co-located workers practice ALARA which mitigates potential dose to co-located workers.</li> </ul>	L:EU C: N R: IV
Contamination	Hazard: Workers encountering contamination managing waste.	L: A C: L R: III	<ul> <li>P – Waste is packaged prior to receipt at the LLWHB or BY by the waste generators, this prevents co-located workers from interacting with waste forms directly.</li> <li>M – Quarterly contamination wipes are taken at both locations and these results are used to mitigate the potential spread of contamination throughout various areas.</li> <li>M – The co-located workers practice ALARA which mitigates potential dose to co-located workers</li> </ul>	L:U C:N R: IV
Radioactive Sources	Hazard: Workers receiving elevated dose managing sources.	L: A C: L R: III	P – Source technicians receive special training for management of sources M – Semi-annual wipes are taken to ensure leak free status P – Source technicians wear special dosimetry while managing sources, and co-located workers are prevented from actively participating in source handling, unless they take specialized training. At that point they would be source technicians, not co-located workers.	L: EU C: N R: IV

Radiological Hazard Consequences, derived from Figu	re C	-1, "Example Qualitativ	e Con	sequence Matrix", DOI	E-HDBK-1163-2020.							
Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	I = situation (event) of major concern				Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		$\mathbf{II} = \text{situation}$ (even	nt) of concern		1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (eve	ent) of minor concern	es	Η	Ι	Ι	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	ent) of minimal concern	nenc	М	II	II	III	IV	
Control(s) Type	С	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edu	т	Ш	Ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge 25.0 \text{ rem}$		$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L			IV	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem $> C \ge 5$ rem	10	00 rem > $\mathbf{C} \ge 25$ rem	100 rem > $\mathbf{C} \ge 25$ rem	<u> </u>	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	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	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: N/A	L:	Public not allowed at LLWHF, BY or HWSF	L:
activation		C:		C:
		R:		R:
Radioactive	Hazard: N/A	L:	Public not allowed at LLWHF, BY or HWSF	L:
waste		C:		C:
		R:		R:
Contamination	Hazard: N/A	L:	Public not allowed at LLWHF, BY or HWSF	L:
		C:		C:
		R:		R:
Radioactive	Hazard: N/A	L:	Public not allowed at LLWHF, BY or HWSF	L:
Sources		C:		C:
		R:		R:

Radiological Hazard Consequences, derived from Figu	re C	-1, "Example Qualitative	e Con	sequence Matrix", DOI	E-HDBK-1163-2020.									
Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	ear	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)			Risk Matrix						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I}$ = situation (event) of major concern					Like	lihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (even	$\mathbf{II} = \text{situation (event) of concern}$			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	ces	Н	Ι	Ι	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible			ent) of minimal concern	en	М	II	II	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edn	т	Ш	Ш	TV.	IV			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge 25.0 \text{ rem}$		$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L	III	III	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	10	00 rem > $\mathbf{C} \ge 25$ rem	100 rem > C ≥ 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	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	$5 \text{ rem} > \mathbf{C}$									

# 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:

Chemical Hazard Consequences, derived from Figure	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event	)/year	Risk (R, Qualitative Ranking)			Matri	x			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I}$ = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (ev	ent) of concern		r	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	Н	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	ouenc	М	II	Π	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge PAC-2$		$C \ge PAC-3$	C≥IDLH	suo	L	III	III	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	P	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	C	Ν	IV	IV	IV	IV
Acronyms IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > C		$\frac{1000 \times 000}{\text{PAC-2} > C}$	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:	*See Section I Chapter 04	L: C: R:

$\mathbf{H} = \text{High}$ $\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$		I = situation (eve II = situation (ev III = situation (ev	,				Like	ihood		
$\mathbf{L} = Low$ $\mathbf{N} = Negligible$		N N	,				Likelihood			
$\mathbf{N} = \mathbf{Negligible}$		III = situation (ev				A	U	EU	BEU	
			vent) of minor concern	es	Η	Ι	Ι	II	III	
		IV = situation (ev	vent) of minimal concern	ences	М	II	Π	III	IV	
C Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	-					
$C \ge PAC-2$		$C \ge PAC-3$	C≥IDLH	suo	L	III	III	IV	IV	
-	P		-	0	Ν	IV	IV	IV	IV	
$\frac{1}{1000} = \frac{1}{1000} = 1$	11	$\frac{10000 \text{ C}}{\text{PAC-2} > \text{C}}$	$PEL \text{ or } TLV_c > C$		•	•				
Consequences less than those for Low Consequence Level		•	Consequences less than those for Low Consequence Level							
1 ; [	Consequences less than those for Low	PAC-1 > C Consequences less than those for Low those	PAC-1 > CPAC-2 > CConsequences lessConsequences less thanthan those for Lowthose for Low Consequence	PAC-1 > CPAC-2 > CPEL or $TLV_c > C$ Consequences lessConsequences less than than those for LowConsequences less than those for Low	PAC-1 > CPAC-2 > CPEL or $TLV_c > C$ Consequences lessConsequences less than than those for LowConsequences less than those for Low	PAC-1 > CPAC-2 > CPEL or $TLV_c > C$ Consequences lessConsequences less than than those for LowConsequences less than those for Low	PAC-2 > C $\geq$ PAC-1PAC-3 > C $\geq$ PAC-2IDLH > C $\geq$ PEL or TLVcPAC-1 > CPAC-2 > CPEL or TLVc > CConsequences lessConsequences less than than those for LowConsequences less than those for Low	PAC-2 > C $\geq$ PAC-1PAC-3 > C $\geq$ PAC-2IDLH > C $\geq$ PEL or TLVcPAC-1 > CPAC-2 > CPEL or TLVc > CConsequences lessConsequences less than those for LowConsequences less than those for Low	PAC-2 > C $\geq$ PAC-1PAC-3 > C $\geq$ PAC-2IDLH > C $\geq$ PEL or ILVcPAC-1 > CPAC-2 > CPEL or TLVc > CConsequences lessConsequences less than those for LowConsequences less than those for Low	

#### 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, lead shot, and lead sheets.	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:

Likelihood (L, of event)/year	C	onsequence (C, of event	)/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
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 (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	ces	Н	Ι	Ι	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	en	М	П	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	$C \ge PAC-2$		$C \ge PAC-3$	C≥IDLH	suo	L	III	III	IV	IV		
$\mathbf{M} = $ Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	P	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	C	Ν	IV	IV	IV	IV		
Acronyms IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > C		$\frac{1000 \times 000}{\text{PAC-2} > C}$	$\frac{12 \text{ EV} + C}{\text{PEL or TLV}_{c} > C}$								
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 2.7 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 materials (cables, Boxes, Paper, wood cribbing, etc.)	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Conse	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	x			
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)		$\mathbf{M} = \mathbf{M}$ 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	TIT	ш	TV.	TV.
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , (	$C \ge$ 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 the	nose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

#### Table 2.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker

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: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	Hazard: N/A	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	$C \ge Prompt worker$	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 2.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard: N/A	L: C:	Public not allowed at LLWHF, BY or HWSF	L: C:
materials		R:		R:
(cables, Boxes,		к.		к.
Paper, wood				
cribbing, etc.)				
Flammable	Hazard: N/A	L:	Public not allowed at LLWHF, BY or HWSF	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
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.								
	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 2.10 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Conse	equence Matrix", DOE-HD	BK-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				-	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)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	se	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	П	Π	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	T	TTT	Ш	TV.	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	111	IV	IV
$\mathbf{M}$ = 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			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	$C \ge$ 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 1	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

# Table 2.11 Thermal Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work	Hazard: N/A	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	year 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)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$	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 (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	П	II	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	T	TTT	TT	TV.	TV /	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge$ Irreversible,	$C \ge Prompt$ worker fatality	$C \ge Prompt worker$	ons	L	III	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-							
<b>MOI</b> = Maximally-exposed Offsite Individual			threatening 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	those for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

# Table 2.12 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	vear 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				-	lihood			
U = Unlikely (1.0E-02>L>1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$	$\mathbf{II} = \text{situation} (\text{ev})$	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	s	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-located worker)	Onsite-1 (facility worker)	Consequences	т	TT	TT	TV.	11.7		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge$ Irreversible,	$C \ge$ Prompt worker fatality	$C \ge Prompt worker$	ons	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			threatening 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	hose for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

# Table 2.13 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Pumps and Motors	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Motion Tables	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Mobile Shielding	Hazard: N/A	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					
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	= situation (event) of major concern				Likelihood				
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.										
	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 2.14 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Pumps and Motors	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Motion Tables	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Mobile Shielding	Hazard: N/A	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	С	onsequence (C, of event)/y	ear Risk (R, Qualitative	Ranking)	Risk	x Matı	ix	<u> </u>						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	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 (ev	vent) of concern		1	Α	U	EU	BEU				
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (e	event) of minor concern	es	Н	Ι	Ι	II	III				
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern	enc	М	II	Π	III	IV				
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	L	III	Ш	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	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Con	N	IV	IV	IV	IV				
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C										

#### Table 2.15 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:
Pumps and Motors	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:
Motion Tables	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:
Mobile Shielding	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Conse	equen	ce Matrix", DOE-HD	BK-1163-2020.										
Likelihood (L, of event)/year	С	onsequence (C, of event)/y	year	Risk (R, Qualitative	Ranking)	Risl	x Mati	ix	x						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	tuation (event) of major concern				Likelihood						
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	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	Н	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	II	III	IV				
Control(s) Type	С	Offsite (MOI)	Onsite-	-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	L	Ш	Ш	IV	IV				
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	Н	other serious effects, or symptoms which	or a ir	rompt worker fatality acute injury that is mmediately life- ening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Cons	N	IV	IV	IV	IV				
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	imme pern hosp M	e Serious injury, no ediate loss of life no manent disabilities; oitalization required. Minor injuries; no ospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C										

# Table 2.16 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Material Handling	Hazard: N/A	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					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (eve	$\mathbf{I}$ = situation (event) of major concern				Likelihood				
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation} (\text{ev})$	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	ienc	М	II	Π	III	IV		
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	III	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	- 111	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	$\mathbf{C} \geq$ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	$\mathbf{L}$	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 Potential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:
Material Handling	Hazard: N/A	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							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	= situation (event) of major concern				Like	elihood			
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)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	es	Н	Ι	Ι	Π	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ences	М	П	П	III	IV		
Control(s) Type	С	Offsite (MOI) 0	nsite-2 (co-located worker)	Onsite-1 (facility worker)	Conseque	T	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	- 111	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 MOI = Maximally-exposed Offsite Individual		or symptoms which	immediately life-	is immediately life-								
Wor Waxmany-exposed onsite individual		<b>^</b>	nreatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective										
		action.	<u>a.</u> a. t. t.t.									
	М	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	$\mathbf{C} \geq$ 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								
			ose for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

# Table 2.18 Potential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:
Material Handling	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	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	Matri	ix						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = \text{situation}$ (even	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	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ , C	$C \ge$ 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	$C \ge$ 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 2.19 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: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	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				Like	lihood	
U = Unlikely (1.0E-02>L>1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation} (\text{ev})$	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	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	П	Π	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	TTT	TT	TV.	11.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ ,	$C \ge Prompt$ worker fatality	$C \ge Prompt worker$	ons	L	III	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-						
<b>MOI</b> = Maximally-exposed Offsite Individual			threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	C C							
		action.								
	М	$C \ge Mild$ , transient	$\mathbf{C} \ge \mathbf{Serious}$ 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 t	hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

#### Table 2.20 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: N/A	L: C: R:	*See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	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				Like	lihood	
U = Unlikely (1.0E-02>L>1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation} (\text{ev})$	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	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	П	Π	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	TTT	TT	TV.	11.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ ,	$C \ge Prompt$ worker fatality	$C \ge Prompt worker$	ons	L	III	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-						
<b>MOI</b> = Maximally-exposed Offsite Individual			threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	C C							
		action.								
	М	$C \ge Mild$ , transient	$\mathbf{C} \ge \mathbf{Serious}$ 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 t	hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

#### Table 2.21 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Ergonomics	Hazard: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "E	Example Qualitative Conse	equence Matrix", DOE-HD	BK-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				-	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		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	s	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	П	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	т	TT	TTT	TV.	11.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	$C \ge$ Irreversible,	$C \ge Prompt$ worker fatality	$C \ge Prompt worker$	ons	L	III	III	IV	IV
$\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			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	$C \ge$ 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	hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

#### **Table 2.22 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>Radioactive soil in beam loss areas beyond allowable concentrations of radionuclides beyond calculated Fermilab limits.</li> <li>Discharge of chemicals into onsite soils beyond permitted limits.</li> <li>t.</li> </ul>	L: C: R:	*See Section I Chapter 04	L: C: <b>R:</b>