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

	Risk Tables Description	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: *

<sup>\*</sup> 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).

 $Table\ 2.1\ Radiological-Onsite-1\ Facility\ Worker$ 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual 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 prevents 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
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.	C: N
		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

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Coı	sequence (C, of event)/	year	Risk (R, Qualitative R	Ranking)	Risk	Risk Matrix					
A = Anticipated (L > 1.0E-02)	$\mathbf{H} = \mathbf{High}$			I = situation (even	t) of major concern			Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern	l		Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	V = situation (event) of minimal concern			II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т .	TTT	111	IV	IV	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	C ≥ 100 rem	ons	L	III	III		- '	
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbb{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV	
Acronyms  MOI - Maximally, avenued Officia Individual	L	5 rem > C		25 rem > C	25 rem > <b>C</b>							
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		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 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	P – Items are surveyed prior to storage locations being identified preventing elevated co-located worker doses from radioactive waste.  P – The workers are trained RCT's  M – Do not have any items in storage > 25 rem, which mitigates potential dose to co-located workers.  M – The co-located workers practice ALARA which mitigates potential dose to co-located workers.	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	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)/y	ear	Risk (R, Qualitative F	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	t) of major concern			Likelihood					
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	s	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible		<b>IV</b> = situation (eve	<b>IV</b> = situation (event) of minimal concern			II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edn	· ·	TTT	TTT	13.7	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem	ons	L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV		
Acronyms  MOI = Maximally, avnesed Offsite Individual	L	5 rem > <b>C</b>		25 rem > C	25 rem > C								
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > 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: 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	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)/	year	Risk (R, Qualitative R	anking)	Risk Matrix								
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		<b>I</b> = situation (even	t) of major concern			Likelihood						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern	l	1	Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)	L = Low			III = situation (eve	ent) of minor concern	es	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		<b>IV</b> = situation (event) of minimal concern		enc	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edn		TTT	777	IV	13.7			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV			
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV			
Acronyms  MOI = Maximally-exposed Offsite Individual	L	5 rem > C		25 rem > C	25 rem > C									
rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		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 unencased 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 Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	C	onsequence (C, of event)	)/year	Risk (R, Qualitative	Ranking)	Risl	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern	l .		A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	es	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т .	Ш	Ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH		L	111	111	1 V	1 V		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual	N	Consequences less		nsequences less than	Consequences less than								
PAC = Protective Action Criteria		than those for Low	those	for Low Consequence	those for Low								
PEL = Permissible Exposure Limit		Consequence Level		Level	Consequence Level								
TLV <sub>c</sub> = Threshold Limit Value (ceiling)													

**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 unencased lead bricks, lead shot, and lead sheets.	L: C: R:	*See Section I Chapter 04	L: C: R:

Co	onsequence (C, of event)									
	insequence (e, or event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix					
	$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern			Likelihood			
	$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			A	U	EU	BEU
	L = Low		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III
	N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nba		***	***	***	** *
Н	C > PAC-2		C > PAC-3	C > IDLH	ons	L	III	111	IV	IV
М		PΔ		V	C	N	IV	IV	IV	IV
T		1 1				i i				'
N	Consequences less than those for Low Consequence Level		nsequences less than	Consequences less than those for Low Consequence Level						
C H N	[ [	L = Low N = Negligible C Offsite (MOI) C $\geq$ PAC-2 I PAC-2 > C $\geq$ PAC-1 PAC-1 > C Consequences less than those for Low		L = Low N = NegligibleIII = situation (ev.)COffsite (MOI)Onsite-2 (co-located worker)I $C \ge PAC-2$ $C \ge PAC-3$ I $PAC-2 \ge C \ge PAC-1$ $PAC-3 \ge C \ge PAC-2$ I $PAC-1 \ge C$ $PAC-2 \ge C$ I $PAC-1 \ge C$ $PAC-2 \ge C$ I $C$ $C$ <td><math display="block"> \begin{array}{c ccccccccccccccccccccccccccccccccccc</math></td> <td>  In Statistical (event) of concern   III = situation (event) of minor concern   IV = situation (event) of minimal concern   IV = situation (event) of mi</td>	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	In Statistical (event) of concern   III = situation (event) of minor concern   IV = situation (event) of minimal concern   IV = situation (event) of mi				

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

Chemical Hazard Consequences, derived from Figure	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	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	es	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ex	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedno	٠ 🖵	TTT	777	TX 7	***		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	p,	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	٥	N	IV	IV	IV	IV		
Acronyms	ī	PAC-1 > C	1.7	$\frac{PAC-2 > C}{PAC-2}$	PEL or $TLV_c > C$				•				
<b>IDLH</b> = Immediately Dangerous to Life and Health	N												
MOI = Maximally-exposed Offsite Individual	1	Consequences less		nsequences less than	Consequences less than								
<b>PAC</b> = Protective Action Criteria		than those for Low	those	for Low Consequence	those for Low								
<b>PEL</b> = Permissible Exposure Limit		Consequence Level		Level	Consequence Level								
TLV <sub>c</sub> = Threshold Limit Value (ceiling)													

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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High		Ranking) ent) of major concern	Risk	Matri	ix	Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$		vent) of minor concern	səə	Н	A I	U I	EU II	BEU
BEU = Beyond Extremely Unlikely (1.0E-06> L)  Control(s) Type P = Preventive (reduce event occurrence likelihood)	С		Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	M L	III	III	III IV	IV IV
M = Mitigative (reduces event consequences)  Acronyms	Н	other serious effects,	C ≥ Prompt worker fatality or acute injury that is	$C \ge Prompt worker$ fatality or acute injury that	Co	N	IV	IV	IV	IV
MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	immediately life- threatening or permanently disabling.	is immediately life- threatening or permanently disabling.						
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low 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, "F	Example Qualitative Cons	equence Matrix", DOE-HD	PBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  L = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	· ·	vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	C ≥ Irreversible,	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L N	III	III IV	IV IV	IV IV
<ul> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.			1,	TV TV	1,	1,
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low 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: N/A	L: C: R:	Public not allowed at LLWHF, BY or HWSF	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	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 Cons	equence Matrix", DOE-HD	DBK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		<ul> <li>M = Moderate</li> <li>L = Low</li> <li>N = Negligible</li> </ul>		vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsı	L	III	III	IV	IV
M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
	N	adverse effects > C  Consequences less than those for Low Consequence Level	hospitalization > C  Consequences less than those for Low Consequence Level	hospitalization > C  Consequences less than those for Low 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, "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				
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) of major concern					lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$			1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ev	vent) of minor concern	es	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible	IV = situation (ev	vent) of minimal concern	en	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	onsite-2 (co-located worker)	Onsite-1 (facility worker)	sednences	L	III	III	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible, (	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V	1 V	
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an t	hreatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	M	$C \ge Mild$ , 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							
	N	Consequences less	Consequences less than	Consequences less than							
			nose 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-	-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	Matr	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) of major concern					lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	ses	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible		vent) of minimal concern	le ne	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	nsite-2 (co-located worker)	Onsite-1 (facility worker)	sednences	T.	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible, C	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V	1 V
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an the	hreatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	M	$C \ge Mild$ , 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						
	N	Consequences less	Consequences less than	Consequences less than						
			nose 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	xample Qualitative Con	sequence Matrix", D	OE-HD	PBK-1163-2020.									
Likelihood (L, of event)/year	C	onsequence (C, of event).	year Risk (R, Qua	alitative	Ranking)	Risk	Matri	x						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situa	tion (eve	ent) of major concern				Likelihood					
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \operatorname{situ}$	ation (ev	vent) of concern			A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = sitt	uation (ev	vent) of minor concern	es	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = sitt	uation (ev	vent) of minimal concern	enc	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located w	vorker)	Onsite-1 (facility worker)	sednences	_	***	***	***	** *			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker	fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV			
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury th	-	fatality or acute injury that	Ŭ	N	IV	IV	IV	IV			
Acronyms		or symptoms which	immediately lif		is immediately life-									
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or perma		threatening or									
		individual's ability to	disabling.	,	permanently disabling.									
		take protective	8											
		action.												
	M	C ≥ Mild, transient	C ≥ Serious injur	y, no	C ≥ Serious injury, no									
		adverse effects.	immediate loss of l	life no	immediate loss of life no									
			permanent disabil	ities;	permanent disabilities;									
			hospitalization req	uired.	hospitalization required.									
	L	Mild, transient	Minor injuries;	no	Minor injuries; no									
		adverse effects > C	hospitalization >	> C	hospitalization > C									
	N	Consequences less	Consequences less	s than	Consequences less than									
		than those for Low	those for Low Conse	equence	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, "F	Example Qualitative Cons	equence Matrix", DOE-HD	PBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  L = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	· ·	vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	C ≥ Irreversible,	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L N	III	III IV	IV IV	IV IV
<ul> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.			1,	TV TV	1,	1,
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low 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-1	l, "E	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern			Likelihood					
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern	_	1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	ses	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sednences	L	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	Н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	Prompt worker fatality acute injury that is immediately life-tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N	IV	IV	IV	IV		
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no rmanent disabilities; pitalization 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 2.15 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	1, "E	xample Qualitative Cor	sequer	nce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix Likelihood							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern								
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern	_	1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	sə	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sednences	L	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	Н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	Prompt worker fatality acute injury that is immediately lifetening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N	IV	IV	IV	IV		
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no rmanent disabilities; pitalization 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, "F	Example Qualitative Cons	equence Matrix", DOE-HD	PBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  L = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	· ·	vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	C ≥ Irreversible,	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L N	III	III IV	IV IV	IV IV
<ul> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.			1,	TV TV	1,	1,
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low 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	Hazard: N/A	L: C:	*See Section I Chapter 04	L: C:
Operations		R:		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 A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	year I		nt) of major concern	Risk	Matri		BEU			
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		<ul><li>M = Moderate</li><li>L = Low</li><li>N = Negligible</li></ul>			ent) of concern vent) of minor concern vent) of minimal concern	suces	H M	I	I II	EU II III	III IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	C H	Offsite (MOI)		2 (co-located worker) ompt worker fatality	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L	III	III	IV	IV	
		other serious effects, or symptoms which could impair an individual's ability to take protective action.	im	cute injury that is nmediately life- ning or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		N	IV	IV	IV	IV	
	M L	C ≥ Mild, transient adverse effects.  Mild, transient	immed perma hospit Mir	Serious injury, no diate loss of life no nanent disabilities; talization required. inor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no							
	N	adverse effects > C  Consequences less than those for Low Consequence Level	Conse	spitalization > C equences less than or Low Consequence Level	hospitalization > C  Consequences less than those for Low 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 A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/ H = High	/year	,	nt) of major concern	Risk	Matri		Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04) EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06 > L)		<ul><li>M = Moderate</li><li>L = Low</li><li>N = Negligible</li></ul>		· ·	ent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	BEU III IV	
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	С			2 (co-located worker) rompt worker fatality	Onsite-1 (facility worker)  C ≥ Prompt worker	nbesu	L	III	III	IV	IV	
		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or a in threate	acute injury that is mmediately life- ening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.	Cor	N	IV	IV	IV	IV	
	M L	C ≥ Mild, transient adverse effects.  Mild, transient	imme perm hospi M	Serious injury, no ediate loss of life no manent disabilities; italization required. Iinor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no							
	N	adverse effects > C  Consequences less than those for Low Consequence Level	Cons	sepitalization > C sequences less than for Low Consequence Level	hospitalization > C  Consequences less than those for Low 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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/ye	ar Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		nt) 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)		L = Low	III = situation (ex	vent) of minor concern	se	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	nsite-2 (co-located worker)	Onsite-1 (facility worker)	sednences		TIT	777	13.7	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible, C	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	1 V		
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an th	reatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective										
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ 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								
	N	Consequences less	Consequences less than	Consequences less than								
			ose 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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (even)	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	se	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sednences	т .	TIT	TIT	137	13.7		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	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.										
	M	$C \ge Mild$ , transient	$C \ge$ Serious injury, no	C ≥ 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								
	N	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 2.21 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, "Example Qualitative Consequence Matrix", DOE-HDBK-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)		$\mathbf{H} = \mathbf{High}$	*	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	*		l	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	,	vent) of minor concern	səa	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	\	vent) of minimal concern	nen	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sednences	Ţ	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$ ,	$C \ge Prompt worker fatality$	$C \ge Prompt worker$	Con							
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	)	N	IV	IV	IV	IV		
Acronyms  MOI - Mayimally averaged Offsite Individual		or symptoms which	immediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		•	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective										
		action.										
	M	$C \ge Mild$ , transient	C ≥ Serious injury, no	C ≥ 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								
	N	Consequences less	Consequences less than	Consequences less than								
			those 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: <ul> <li>Airborne release of radionuclides beyond permitted limits.</li> <li>Discharge of chemicals into onsite surface waters beyond permitted limits.</li> </ul> </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>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>