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: *

^{*} 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	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	C: L	elevated worker dose from residual activation.	C: N
	activations.	R: III	 P – The workers are trained RCT's, and training and awareness prevents them from receiving elevated doses from waste items M – Do not have any items in storage > 25 rem, which mitigates the potential dose to workers. M – The workers practice ALARA, which mitigates potential dose to workers. 	R: IV
Radioactive	Hazard: Worker receiving elevated	L: A	P – Items are surveyed prior to storage locations being identified to prevent	L:EU
waste	dose from radioactive waste.	C: L	elevated worker dose from residual activation.	C: N
		R: III	 P – The workers are trained RCT's and training and awareness prevents them from receiving elevated doses from waste items. M – Do not have any items in storage > 25 rem, which mitigates the potential dose to workers. M – The workers practice ALARA, which mitigates potential dose to workers. 	R: IV
Contamination	Hazard: Workers encountering contamination managing waste.	L: A C: L R: III	 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. M – Quarterly contamination wipes are taken at both locations, and these results are used to mitigate the potential spread of contamination throughout various areas. M – The workers practice ALARA, which mitigates potential spread of contamination among workers. 	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 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	year	Risk (R, Qualitative R	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 (event) of concern			1	Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ences	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern			M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	nba								
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	Suo	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 - Manipully and a Office Individual	L	5 rem > C		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 2.2 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	 P – Items are surveyed prior to storage locations being identified to prevent elevated co-located worker dose from residual activation. P – The workers are trained RCT's and training and awareness prevents potential for receiving elevated doses from waste items. M – Do not have any items in storage > 25 rem M – The co-located workers practice ALARA 	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	 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. M – Quarterly contamination wipes are taken at both locations and these results are used to mitigate the potential spread of contamination throughout various areas. M – The co-located workers practice ALARA which mitigates potential dose to co-located workers 	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	Coı	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	II = situation (event) of concern			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			
BEU = Beyond Extremely Unlikely (1.0E-06> L)	$\mathbf{N} = \text{Negligible}$			IV = situation (event) of minimal concern		enc	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	edn	Ţ	Ш	Ш	IV	IV			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	Suo?	L	111		1 V	- '			
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	5 rem $100 \text{ rem} > C \ge 25 \text{ rem}$ $100 \text{ rem} > C \ge 25 \text{ rem}$		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 > 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)		$\mathbf{H} = \mathbf{High}$		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		_	A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (event) of minor concern			Н	I	I	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ences	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edn	τ.	TTT	TTT	13.7	13.7			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 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, averaged Officia Individual	L	5 rem > C		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 2.4 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	e 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	Α	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		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ence	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	· ·	Ш	Ш	IV	IV		
P = Preventive (reduce event occurrence likelihood)	H M	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	1111	111	1 V	1 V		
M = Mitigative (reduces event consequences)		$PAC-2 > C \ge PAC-1$	P.A	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
MOI = Maximally-exposed Offsite Individual	N	Consequences less	Cor	sequences 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 _c = 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:

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)			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 (ex	vent) of minor concern	es	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ence	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	TTT	77.7	77.7	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	P	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV	
Acronyms	T	PAC-1 > C	1.7	$\frac{\text{PAC-2} > \mathbf{C}}{\text{PAC-2} > \mathbf{C}}$	PEL or $TLV_c > C$		•		•	•		
IDLH = Immediately Dangerous to Life and Health	N.T.				-							
MOI = Maximally-exposed Offsite Individual	IN	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 _c = Threshold Limit Value (ceiling)												

Table 2.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead dust during manual handling of 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	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)			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)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	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	es	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ence	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	TTT	77.7	17.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	P	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms	ī	PAC-1 > C	1 7	$\frac{\text{PAC-2} > \mathbf{C}}{\text{PAC-2} > \mathbf{C}}$	PEL or $TLV_c > C$								
IDLH = Immediately Dangerous to Life and Health	L				-								
MOI = Maximally-exposed Offsite Individual	IN	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 _c = 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, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02) L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	A	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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	EU II	III
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsu	M L	III	III	III	IV IV
M = Mitigative (reduces event consequences)		other serious effects,	C ≥ Prompt worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that	Cor	N	IV	IV	IV	IV
Acronyms 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 $> \mathbf{C}$	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 Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02) L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	A	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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	EU II	III
Control(s) Type P = Preventive (reduce event occurrence likelihood)	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsu	M L	III	III	III	IV IV
M = Mitigative (reduces event consequences)	П	other serious effects,	C ≥ Prompt worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that	Cor	N	IV	IV	IV	IV
Acronyms 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 $> \mathbb{C}$	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 2.9 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 Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02) L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	A	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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	EU II	III
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsu	M L	III	III	III	IV IV
M = Mitigative (reduces event consequences)		other serious effects,	C ≥ Prompt worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that	Cor	N	IV	IV	IV	IV
Acronyms 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 $> \mathbf{C}$	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 2.10 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	l, "F	Example Qualitative Con	sequence Matri	x", DOE-HD	BK-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 (ev	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III	= situation (e	vent) of minor concern	nces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV:	= situation (ev	vent) of minimal concern	enc	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-loca	ted worker)	Onsite-1 (facility worker)	edn	т .	TTT	TTT	13.7	13.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt wo	rker fatality	C ≥ Prompt worker	Coms	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute inju	•	fatality or acute injury that		N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediate	-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or p	•	threatening or								
		individual's ability to	disabli	ng.	permanently disabling.								
		take protective											
		action.											
	M	$C \ge Mild$, transient	C ≥ Serious	injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate los	s of life no	immediate loss of life no								
			permanent di	sabilities;	permanent disabilities;								
			hospitalization	n required.	hospitalization required.								
	L	Mild, transient	Minor inju	ries; no	Minor injuries; no								
		adverse effects > C	hospitalizat	ion > C	hospitalization > C								
	N	Consequences less	Consequence		Consequences less than								
		than those for Low	those for Low C	Consequence	those for Low								
		Consequence Level	Leve	el	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, "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	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	event) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	sedneuces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern		M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	llbə	_	777	TTT	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	Ö	N	IV	IV	IV	IV
Acronyms		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	٥							
		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						
		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 Cons	sequence 1	Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year Ri	isk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (evolution)	ent) of concern			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
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	П	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	-	TTT	777	77.7	TX /
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > Pron	npt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		ite injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which		nediately life-	is immediately life-			•			
MOI = Maximally-exposed Offsite Individual		could impair an		ng or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		C							
		action.									
	M	C ≥ Mild, transient	C ≥ Se	erious injury, no	C ≥ Serious injury, no						
		adverse effects.	immedia	ate loss of life no	immediate loss of life no						
			perman	nent disabilities;	permanent disabilities;						
			hospital	lization required.	hospitalization required.						
	L	Mild, transient	Mino	or injuries; no	Minor injuries; no						
		adverse effects > C	hospi	italization > C	hospitalization > C						
	N	Consequences less	Conseq	quences less than	Consequences less than						
		than those for Low	those 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, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02) L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	A	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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	II	BEU		
Control(s) Type P = Preventive (reduce event occurrence likelihood)	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsu	M L	III	III	III	IV IV		
M = Mitigative (reduces event consequences)	П	other serious effects,	C ≥ Prompt worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that	Cor	N	IV	IV	IV	IV		
Acronyms 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 $> \mathbb{C}$	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 2.14 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, "F	Example Qualitative Cons	sequen	ce 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	ent) 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 (ex	vent) of minor concern	es	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	ī	Ш	III	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	Н	C ≥ Irreversible, other serious effects,		rompt worker fatality acute injury that is	C ≥ Prompt worker fatality or acute injury that	Con	N	IV	IV	IV	IV		
MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.		mmediately life- ening or permanently disabling.	is immediately life- threatening or permanently disabling.								
	M	C ≥ Mild, transient adverse effects.	imm per	≥ Serious injury, no lediate loss of life no manent disabilities; bitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.								
	L	Mild, transient adverse effects > C		Minor injuries; no ospitalization > C	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 Cons	sequen	ce 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	ent) 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 (ex	vent) of minor concern	es	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	ī	Ш	III	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	Н	C ≥ Irreversible, other serious effects,		rompt worker fatality acute injury that is	C ≥ Prompt worker fatality or acute injury that	Con	N	IV	IV	IV	IV		
MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.		mmediately life- ening or permanently disabling.	is immediately life- threatening or permanently disabling.								
	M	C ≥ Mild, transient adverse effects.	imm per	≥ Serious injury, no lediate loss of life no manent disabilities; bitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.								
	L	Mild, transient adverse effects > C		Minor injuries; no ospitalization > C	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	l, "F	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	year Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
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 (even	event) 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	es	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	TTT	77.7	17.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV		
Acronyms		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	C									
		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								
		than those for Low	those 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:	*See Section I Chapter 04	L: C:
Material Handling	Hazard: N/A	R: L: C: R:	*See Section I Chapter 04	R: 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 Matrix						
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 (ev)	vent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	event) of minor concern	nces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern	E	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	777	TTT	77.7	77.7	
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Coms	L	III	III	IV	IV	
		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-			•	•	•		
MOI = Maximally-exposed Offsite Individual		could impair an	threatening 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							
		than those for Low	those 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 A = Anticipated (L > 1.0E-02) L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	= High I = situation (event) of major concern						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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	C H	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsu	L	III	III	III	IV IV	
	11	other serious effects,	C ≥ Prompt worker fatality or acute injury that is	$C \ge Prompt worker$ fatality or acute injury that	Cor	N	IV	IV	IV	IV	
		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 $> \mathbb{C}$	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 2.19 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 A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	, , -	Ranking) ent) of major concern	Risk	Matri	x	Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev				A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	,	event) of minor concern	seo	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L) Control(s) Type	C	N = Negligible Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	M	II	II	III	IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	Н	,		$C \ge Prompt worker$	nsec	L	III	III	IV	IV	
	11	other serious effects,	or acute injury that is	fatality or acute injury that	Con	N	IV	IV	IV	IV	
		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	Consequences less than	Consequences less than							
		*	those for Low Consequence Level	those for Low 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 A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	, , -	Ranking) ent) of major concern	Risk	Matri	x	Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev				A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	,	event) of minor concern	seo	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L) Control(s) Type	C	N = Negligible Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	M	II	II	III	IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	Н	,		$C \ge Prompt worker$	nsec	L	III	III	IV	IV	
	11	other serious effects,	or acute injury that is	fatality or acute injury that	Con	N	IV	IV	IV	IV	
		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	Consequences less than	Consequences less than							
		*	those for Low Consequence Level	those for Low 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, Qualitat	ive Ranking)	Risl	K Matr	ix				
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation	event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation	(event) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation	(event) of minor concern	S	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation	(event) of minimal concern	enc	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worke	Onsite-1 (facility worker)	Consequences						
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatali	ty C ≥ Prompt worker	ons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	Ö	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-		1					
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanent								
		individual's ability to	disabling.	permanently disabling.							
		take protective	<i>B</i> -	rg.							
		action.									
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no	1						
		adverse effects.	immediate loss of life n	2 2							
			permanent disabilities;	permanent disabilities;							
			hospitalization required	_							
	L	Mild, transient	Minor injuries; no	Minor injuries; no	1						
		adverse effects > C	hospitalization > C	hospitalization > C							
	N	Consequences less	Consequences less than	Consequences less than	1						
		than those for Low	those for Low Consequen	ce 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	 Hazard: Airborne release of radionuclides beyond permitted limits. Discharge of chemicals into onsite surface waters beyond permitted limits. 	L: C: R:	*See Section I Chapter 04	L: C: R:
Water	 Hazard: Discharge of radionuclides into onsite surface waters beyond permitted limits. Discharge of chemicals into onsite surface waters beyond permitted limits. 	L: C: R:	*See Section I Chapter 04	L: C: R:

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Soil	 Radioactive soil in beam loss areas beyond allowable concentrations of radionuclides beyond calculated Fermilab limits. Discharge of chemicals into onsite soils beyond permitted limits. t. 	L: C: R:	*See Section I Chapter 04	L: C: R: