Table 2. Summary of Baseline and Residual Risks - Linac

	Risk Tables Description	Baseline Risk	Residual Risk
2.1	Radiological – Onsite-1 Facility Worker	R: I	R: III, IV
2.2	Radiological – Onsite-2 Co-located Worker	R: I	R: III, IV
2.3	Radiological – MOI Offsite	R: I	R: IV
2.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
2.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
2.6	Toxic Materials – MOI Offsite	R: *	R: *
2.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: I, *	R: IV, *
2.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: I, *	R: IV, *
2.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
2.10	Electrical Energy – Onsite-1 Facility Worker	R: I, *	R: IV, *
2.11	Electrical Energy – Onsite-2 Co-located Worker	R: I, *	R: IV, *
2.12	Electrical Energy – MOI Offsite	R: *	R: *
2.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
2.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
2.15	Thermal Energy – MOI Offsite	R: *	R: *
2.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
2.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
2.18	Kinetic Energy – MOI Offsite	R: *	R: *
2.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
2.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
2.21	Potential Energy – MOI Offsite	R: *	R: *
2.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
2.23	Magnetic Fields – Onsite-2 Co-located Worker	R: I	R: III
2.24	Magnetic Fields – MOI Offsite	R: N/A	R: N/A
2.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
2.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
2.27	Other Hazards – MOI Offsite	R: *	R: *
2.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
2.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
2.30	Access & Egress – MOI Offsite	R: *	R: *
2.31	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			Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazards: Exposure to ionizing radiation from	L: A	P – Interlocked beam loss detectors	L: BEU
Radiation	beam	C: H	P – Interlocked doors	C: M
		R: I	P – Employee Rad Worker training	R: IV
	Exposure to ionizing radiation from klystrons		M – Shielding	
		L: A		L: A
		C: M	P – Proper operation of klystron	C: N
		R: II	M – Shielding	R: IV
			M – ESH gallery radiation surveys	
Residual Activation	Hazard: Radiation exposure	L: A	P – Employee Rad Worker training	L: EU
		C: H	P – ALARA plan	C: L
		R: I	M – Shielding to reduce activation	R: IV
			M – Proper dosimetry	
Radioactive Waste	Hazard: Radiation exposure	L: A	P – Postings	L: EU
		C: H	P – Beam tuned to reduce beam loss to reduce generation	C: L
		R: I	of waste	R: IV
			M – Shielding to reduce generation of waste	
			M – Material survey and release process	
Contamination	Hazard: Personnel exposure	L: A	P – Radiological controls personnel survey and	L: EU
		C: H	decontamination	C: L
		R: I	P – Postings place in the event contamination is identified	R: IV
			M – Shielding to reduce activation	
			M – Proper PPE specified in RWP	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Non-ionizing Radiation – Laser	Hazards: Exposure to Class 3B and 4 lasers	L: A C: H R: I	P – Class 1 (light tight) enclosures P – ORC and work planning processes P – Locked/Interlocked system P – LOTO procedure or other procedure approved by the LSO P – Affected areas are posted M – Use of PPE	L: BEU C: M R: IV
	Exposure to Class 3R lasers	L: A C: L R: III	No analysis required	L: A C: L R: III
	Exposure to Class 1 and 2 Lasers	L: A C: N R: IV	No analysis required	L: A C: N R: IV
Non-ionizing Radiation – RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P – RF Shielding P – ES&H periodic monitoring P – LOTO procedure P – Affected area postings	L: BEU C: M R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)			Risk Matrix						
A = Anticipated (L > 1.0E-02)	$\mathbf{H} = \mathbf{High}$			I = situation (event) of major concern					Like	lihood				
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)	$\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$			III = situation (eve	ent) of minor concern	sə	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)				IV = situation (eve	ent) 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	_	***	***	***	***			
P: = Preventive (reduce event occurrence	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV			
likelihood)	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	C	N	IV	IV	IV	IV			
M = Mitigative (reduces event consequences)	L	5 rem > C		25 rem > C	25 rem > C									
Acronyms MOI = Maximally-exposed Offsite Individual	N	0.5 rem > C		5 rem > C	5 rem > C									
rem = Roentgen equivalent man														

Table 2.2 Radiological – Onsite-2 Co-located Worker

Hazard	(without controls)		Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	Hazards: Exposure to ionizing radiation from beam	L: A C: H R: I	P – Interlocked beam loss detectors P – Interlocked doors P – Employee Rad Worker training M – Shielding	L: BEU C: M R: IV
	Exposure to ionizing radiation from klystrons	L: A C: M R: II	P – Proper operation of klystron M – Shielding M – ESH gallery radiation surveys	L: A C: N R: IV
Residual Activation	Hazard: Radiation exposure	L: A C: H R: I	P – Employee Rad Worker training P – ALARA plan M – Shielding to reduce activation M – Proper dosimetry	L: EU C: L R: IV
Radioactive Waste	Hazard: Radiation exposure	L: A C: H R: I	P – Postings P – Beam tuned to reduce beam loss M – Shielding to reduce generation of waste M – Material survey and release process	L: EU C: L R: IV
Contamination	Hazard: Radiation exposure	L: A C: H R: I	P – Radiological controls personnel survey and decontamination P – Postings place in the event contamination is identified M – Shielding to reduce generation of waste M – Material survey and release process	L: EU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Non-ionizing Radiation – Laser	Hazards: Exposure to Class 3B and 4 lasers	L: A C: H R: I	P – Class 1 (light tight) enclosures P – Locked/Interlocked system or administrative control approved by the LSO P – LOTO procedure or other procedure approved by the LSO P – Affected areas are posted	L: BEU C: H R: IV
	Exposure to Class 3R lasers	L: A C: L R: III	No analysis required	L: A C: L R: III
	Exposure to Class 1 and 2 Lasers	L: A C: N R: IV	No analysis required	L: A C: N R: IV
Non-ionizing Radiation – RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P: RF Shielding P: ES&H periodic monitoring P: LOTO procedure performed by facility worker P: Affected area postings	L: BEU C: M R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative Ranking)			Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)	$\mathbf{M} = \mathbf{Moderate}$			II = situation (event) of concern				Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)	$\mathbf{L} = \mathbf{Low}$			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			M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***	***	***	***		
P: = Preventive (reduce event occurrence	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	ous	L	III	III	IV	IV		
likelihood)	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	C	N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)	L	5 rem > C		25 rem > C	25 rem > C								
Acronyms MOI = Maximally-exposed Offsite Individual	N	0.5 rem > C		5 rem > C	5 rem > C								
rem = Roentgen equivalent man													

Table 2.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazards: Exposure to ionizing	L: A	P – Interlocked beam loss detectors	L: BEU
Radiation	radiation from beam	C: H	P – Interlocked doors	C: M
		R: I	M – Shielding	R: IV
	Exposure to ionizing radiation from klystrons	L:N/A C:	Hazard does not apply to the public	L: N/A C:
		R:		R:
Residual	Hazard: Radiation exposure	L: N/A	Hazard does not apply to the public	L: N/A
Activation		C:		C:
		R:		R:
Radioactive	Hazard: Radiation exposure	L: N/A	Hazard does not apply to the public	L: N/A
Waste		C:		C:
		R:		R:
Contamination	Hazard: Radiation exposure	L: N/A	Hazard does not apply to the public	L: N/A
		C:		C:
		R:		R:
Non-ionizing	N/A	L:		L:
Radiation		C:		C:
Hazards		R:		R:

Likelihood (L, of event)/year	Cor	sequence (C, of event)/y	ear Risk (R, Qualitativ	e Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ex	I = situation (event) of major concern				Like	elihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (event) 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 (IV = situation (event) of minimal concern			II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker	Onsite-1 (facility worker)	edn	_	YYY	***	77.7	***	
P: = Preventive (reduce event occurrence	Н	C ≥ 25.0 rem	C ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV	
likelihood)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$		N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)	L	5 rem > C	25 rem > C	25 rem > C							
Acronyms MOI = Maximally-exposed Offsite Individual	N	0.5 rem > C	5 rem > C	5 rem > C							
rem = Roentgen equivalent man											

Table 2.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Beryllium		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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)	Ris	k Mat	rix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood			
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)		$\mathbf{L} = \mathbf{Low}$		III = situation (ex	III = situation (event) of minor concern		Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N} = \text{Negligible}$		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)	nbə	т.	Ш	Ш	IV	IV		
P: = Preventive (reduce event occurrence	Н	H $C \ge PAC-2$		C ≥ PAC-3	C ≥ IDLH	ons	L	111	111	1 V	1 V		
likelihood)	$\mathbf{M} PAC-2 > \mathbf{C} \ge PAC-1$		$PAC-3 > C \ge PAC-2$		$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
Acronyms IDLH = Immediately Dangerous to Life and Health	N	Consequences less the		nsequences less than for Low Consequence	Consequences less than								
MOI = Maximally-exposed Offsite Individual P:AC = Protective Action Criteria		than those for Low Consequence Level	those	Level	those for Low Consequence Level								
P:EL = Permissible Exposure Limit TI V = Threshold Limit Value (ceiling)													
					1								

Table 2.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Beryllium		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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	Co	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 (ex	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	enc	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	r	TIT	Ш	IV	IV	
P: = Preventive (reduce event occurrence	Н	C ≥ PAC-2	C ≥ PAC-3		C ≥ IDLH	ons	L	III	111	1 V	1 V	
likelihood)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	C	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$							
Acronyms IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual P:AC = Protective Action Criteria P:EL = Permissible Exposure Limit	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level							
TLV _c = Threshold Limit Value (ceiling)												

Table 2.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Beryllium		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Chemical Hazard Consequences, derived from Figure	e C-1	, "Example Qualitative	Consec	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Ris	k Mat	rix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
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	s	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	N = Negligible		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)	nbə	т.	Ш	Ш	IV	IV
P: = Preventive (reduce event occurrence	Н	$\mathbf{C} \geq \mathbf{PAC-2}$		C ≥ PAC-3	C ≥ IDLH	ons	L	111	111	1 V	1 V
likelihood)	M	$PAC-2 > C \ge PAC-1$	P.A	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$						
Acronyms IDLH = Immediately Dangerous to Life and Health	N	Consequences less than those for Low		nsequences less than for Low Consequence	Consequences less than those for Low						
MOI = Maximally-exposed Offsite Individual P:AC = Protective Action Criteria		Consequence Level	those	Level	Consequence Level						
P:EL = Permissible Exposure Limit TI V = Threshold Limit Value (ceiling)											
					1						

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
Materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable	Hazard: H2 leaking, igniting, and	L: A	P – Biannual leak inspections	L: U
Materials	causing a fire.	C: H	M – Hydrogen leak detectors	C: N
(Flammable gas,		R: I	M – Fire department response	R: IV
cleaning			M – Evacuation training/evacuation drills	
materials, etc.)				
	Other flammable materials	L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020. Likelihood (L. of event)/year Risk (R. Qualitative Ranking) Risk Matrix												
Likelihood (L, of event)/year	consequence (e) or event, year running,											
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 (even	*			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV	
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V		
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which	im	nmediately life-	is immediately life-							
Acronyms		could impair an	threater	ning or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	M	$C \ge Mild$, transient	$C \ge 3$	Serious injury, no	$C \ge Serious injury, no$							
		adverse effects.	immed	diate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
				talization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C		spitalization > C	hospitalization > C							
	N	Consequences less		equences less than	Consequences less than							
			those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable	Hazards: H2 leaking, igniting, and	L: A	P – Biannual leak inspections	L: U
Materials	causing a fire.	C: H	M – Hydrogen leak detectors	C: N
(Flammable gas,		R: I	M – Fire department response	R: IV
cleaning			M – Evacuation training/evacuation drills	
materials, etc.)				
	Other flammable materials		See Section I Chapter 04	L:
		L:		C:
		C:		R
		R		

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020. Likelihood (L. of event)/year Risk (R. Qualitative Ranking) Risk Matrix												
Likelihood (L, of event)/year	consequence (e) or events, year rush (ri) quantum (ri) qu											
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 (even	· ·			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV	
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	$C \ge Pro$	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V		
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-							
Acronyms		could impair an	threate	ening or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	M	$C \ge Mild$, transient	$C \ge 1$	Serious injury, no	$C \ge Serious injury, no$							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
				italization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C		spitalization > C	hospitalization > C							
	N	Consequences less		sequences less than	Consequences less than							
			those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 2.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable	Hazards:H2 leak igniting and	L: N/A	Hazard does not extend to offsite areas	L: N/A
Materials	causing a fire	C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				
	Hazard: Other flammable materials	L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020. Likelihood (L. of event)/year Risk (R. Qualitative Ranking) Risk Matrix												
Likelihood (L, of event)/year	consequence (e) or events, year rush (ri) quantum (ri) qu											
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 (even	· ·			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV	
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	$C \ge Pro$	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V		
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-							
Acronyms		could impair an	threate	ening or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	M	$C \ge Mild$, transient	$C \ge 1$	Serious injury, no	$C \ge Serious injury, no$							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
				italization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C		spitalization > C	hospitalization > C							
	N	Consequences less		sequences less than	Consequences less than							
			those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 2.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery	L:A	P – Store capacitors with terminals grounded	L:BEU
Exposure	present shock hazard.	C:M	P – Capacitor storage away from common areas	C:M
		R:II	P – Electrical worker training	R:IV
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,	Hazards: Burns caused by contact	L:U	P – Insulating guards/closed cabinets prevent incidental contact	L:BEU
High Current	with legacy conductors. The general	C:M	P – Electrical worker training	C:M
Exposure.	controls in Section I, Ch. 4 are not	R:II	P – Removal of metallic jewelry	R:IV
	applicable.		P – Conductors are posted as: "Caution High Current"	
	Dropped tools causing arc flash	L:U	P – Insulating guards/closed cabinets prevent incidental contact	L:BEU
		C:H	P – Electrical worker training	C:M
		R:I	P – Conductors are posted as: "Caution High Current"	R:VI
			M – Overcurrent protection	

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020. Likelihood (L. of event)/year Risk (R. Qualitative Ranking) Risk Matrix												
Likelihood (L, of event)/year	consequence (e) of events, year											
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 (even	· ·			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible			vent) of minimal concern		M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV	
P: = Preventive (reduce event occurrence	Н	$C \ge Irreversible$,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V		
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-							
Acronyms		could impair an	threater	ning or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	M	$C \ge Mild$, transient	$C \ge S$	Serious injury, no	$C \ge Serious injury, no$							
		adverse effects.	immed	diate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
				talization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C		spitalization > C	hospitalization > C							
	N	Consequences less		equences less than	Consequences less than							
		than those for Low	those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 2.11 Electrical Energy 1 Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery present	L:A	P – Store capacitors with terminals grounded	L:BEU
Exposure	shock hazard.	C:M	P – Capacitor storage away from common areas	C:M
		R:II	P – Electrical worker training	R:IV
High Voltage Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
Low Voltage, High	Hazards: Burns caused by contact with legacy	L:U	P – Insulating guards/closed cabinets prevent incidental	L:BEU
Current Exposure.	conductors. The general controls in Section I,	C:M	contact	C:M
	Ch. 4 are not applicable.	R:II	P – Electrical worker training P – Removal of metallic jewelry P – Conductors are posted as: "Caution High Current"	R:IV
	Dropped tools causing arc flash	L:U		L:BEU
		С:Н	P – Insulating guards/closed cabinets prevent incidental	C:M
		R:I	contact P – Electrical worker training P – Conductors are posted as: "Caution High Current" M – Overcurrent protection	R:VI

Other Hazard Consequences, derived from Figure C-1	, "E	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.									
Likelihood (L, of event)/year	C	consequence (c, or event)/year rush (ri, quantum ve rushing)						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	· ·			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV			
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	$C \ge Pro$	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V				
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV			
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-									
Acronyms		could impair an	threate	ening or permanently	threatening or									
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.									
		take protective												
		action.												
	M	$C \ge Mild$, transient	$C \ge 1$	Serious injury, no	$C \ge Serious injury, no$									
		adverse effects.	imme	ediate loss of life no	immediate loss of life no									
			perm	nanent disabilities;	permanent disabilities;									
				italization required.	hospitalization required.									
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no									
		adverse effects > C		spitalization > C	hospitalization > C									
	N	Consequences less		sequences less than	Consequences less than									
			those fo	or Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

Table 2.12 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery	L:	Hazard does not apply to the public.	L:
Exposure	present shock hazard.	C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,	Hazards: Burns caused by contact	L:	Hazard does not apply to the public.	L:
High Current	with legacy conductors. The general	C:		C:
Exposure.	controls in Section I, Ch. 4 are not applicable.	R:		R:
	Dropped tools causing arc flash			

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.									
Likelihood (L, of event)/year	C	Consequence (C, of event)/year Risk (R, Qualitative Ranking)						ix	x					
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)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	*	l -		Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		·	vent) of minor concern	nces	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV			
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V				
likelihood)		other serious effects,		acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV			
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-									
Acronyms		could impair an	threate	ening or permanently	threatening or									
MOI = Maximally-exposed Offsite Individual		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.	imme	ediate loss of life no	immediate loss of life no									
			pern	nanent disabilities;	permanent disabilities;									
				italization required.	hospitalization required.									
	L	Mild, transient	M	linor injuries; no	Minor injuries; no									
		adverse effects > C	ho	spitalization > C	hospitalization > C									
	N	Consequences less		sequences less than	Consequences less than									
		than those for Low	those for	or Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

Table 2.13 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	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)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{H} = \text{situation (ev}$	· ·			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		·	vent) of minor concern	uces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		\	vent) of minimal concern		M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV		
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	$C \ge Pre$	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V			
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)		or symptoms which	in	nmediately life-	is immediately life-								
Acronyms		could impair an	threate	ening or permanently	threatening or								
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.								
		take protective											
		action.											
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	$C \ge Serious injury, no$								
		adverse effects.	imme	ediate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
				italization required.	hospitalization required.								
	L	Mild, transient	M	inor injuries; no	Minor injuries; no								
		adverse effects > C		spitalization > C	hospitalization > C								
	N	Consequences less		sequences less than	Consequences less than								
			those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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) U = 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	Matr	ix A	Like U	lihood EU	BEU
EU = Extremely Unlikely $(1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ BEU = Beyond Extremely Unlikely $(1.0\text{E}-06 > \text{L})$		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$,	vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	II	III IV
Control(s) Type P: = Preventive (reduce event occurrence	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) C ≥ Prompt worker	Conseque	L	III	III	IV	IV
likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		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.		N	IV	IV	IV	IV
	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 2.15 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	Risk	Matri	X							
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)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	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	s	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	т .	TIT	TIT	137	IV		
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	1 V		
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-								
Acronyms			threatening or permanently	threatening or								
MOI = Maximally-exposed Offsite Individual		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 2.16 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power Tools		L: C:	See Section I Chapter 04	L: C:
		R:		R:
Motion Tables		L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and		L:	See Section I Chapter 04	L:
Motors		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	sequence Matrix", DOE-HD	DBK-1163-2020.							
Likelihood (L, of event)/year	C	onsequence (C, of event)/	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	vent) 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	s	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	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)	sedneuces	_	TTT	TTT	77.7	77.7	
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV	
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-							
Acronyms		could impair an	threatening or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to	disabling.	permanently disabling.							
		take protective	S								
		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 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools		L: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables		L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors		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		Consequence (C, of event)/year		Risk (R, Qualitative Ranking)		Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\hat{\mathbf{H}} = \mathbf{High}$		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 (ev	= situation (event) of minor concern		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	С	Offsite (MOI) Onsit		-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	L	III	III	IV	IV
P: = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	rompt worker fatality acute injury that is mmediately life- tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.			IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	imm per hos <u>p</u>	E Serious injury, no sediate loss of life no manent disabilities; bitalization 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 2.18 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Motion Tables		L:	See Section I Chapter 04	L:
Motion Tables		C:		C:
		R:		R:
Pumps and		L:	See Section I Chapter 04	L:
Motors		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	1, "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	ent) 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 (e	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	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 2.19 P:otential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		L: C:	See Section I Chapter 04	L: C:
Compressed		R: L:	See Section I Chapter 04	R: L:
Gasses		C: R:		C: R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure		C:		C:
Vessels/Piping		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Material Handling		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Con	sequenc	ce Matrix", 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 (even	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	uces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	edn	т	TIT	III	IV	IV	
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	111	1 V	1 V	
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that		N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-							
Acronyms		could impair an	threate	ening or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		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.	imme	diate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
			hospi	italization required.	hospitalization required.							
	L	Mild, transient	M	inor injuries; no	Minor injuries; no							
		adverse effects > C	hos	spitalization > C	hospitalization > C							
	N	Consequences less	Cons	sequences less than	Consequences less than							
		than those for Low	those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 2.20 P:otential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Compressed		L:	See Section I Chapter 04	L:
Gasses		C:		C:
		R:		R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure		C:		C:
Vessels/Piping		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:	•	C:
		R:		R:
Material Handling		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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) U = 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	Likelihood		
EU = Extremely Unlikely $(1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ BEU = Beyond Extremely Unlikely $(1.0\text{E}-06 > \text{L})$		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$,	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	BEU III IV
Control(s) Type P: = Preventive (reduce event occurrence	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) C ≥ Prompt worker	Conseque	L	III	III	IV	IV
likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		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.		N	IV	IV	IV	IV
	М	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 2.21 P:otential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		L: C:	See Section I Chapter 04	L: C:
		R:		R:
Compressed		L:	See Section I Chapter 04	L:
Gasses		C:		C:
		R:		R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure		C:		C:
Vessels/Piping		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Material Handling		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Con	sequenc	e Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	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	· ·			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		\	vent) of minimal concern		M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV		
P: = Preventive (reduce event occurrence	Н	$C \ge Irreversible$,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V			
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-								
Acronyms		could impair an	threater	ning or permanently	threatening or								
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.								
		take protective											
		action.											
	M	$C \ge Mild$, transient	$C \ge S$	Serious injury, no	$C \ge Serious injury, no$								
		adverse effects.	immed	diate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
				talization required.	hospitalization required.								
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no								
		adverse effects > C		spitalization > C	hospitalization > C								
	N	Consequences less		equences less than	Consequences less than								
		than those for Low	those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 2.22 Magnetic Fields – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fringe Fields	Hazard: Fringe fields causing heart	L: A	P – Work planning that warns about magnetic hazard.	L: BEU
	pacemaker malfunction	C: H	P – Magnetic hazard warning part of hazard specification sheet.	C: H
		R: I	P – Postings of magnetic field hazard at entry points.	R: III

Other Hazard Consequences, derived from Figure C-1	1, "E	Example Qualitative Con	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern		ı	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	s	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)	nbə		TTT	777	17.7	17.7
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C > P	rompt worker fatality	C ≥ Prompt worker	ous	L	III	III	IV	IV
likelihood)		other serious effects,		acute injury that is	fatality or acute injury that	Ö	N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)		or symptoms which		mmediately life-	is immediately life-						
Acronyms		could impair an		ening or permanently	threatening or						
MOI = Maximally-exposed Offsite Individual		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.	imm	ediate loss of life no	immediate loss of life no						
			peri	manent disabilities;	permanent disabilities;						
			hosp	oitalization required.	hospitalization required.						
	L	Mild, transient	N	Inor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization > C						
	N	Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those t	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.23 Magnetic Fields – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fringe Fields	Hazard: Fringe fields causing heart	L: A	P – Work planning that warns about magnetic hazard.	L: BEU
	pacemaker malfunction	C: H	P – Magnetic hazard warning part of hazard specification sheet.	C: H
		R: I	P – Postings of magnetic field hazard at entry points.	R: III

Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) of major concern						
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
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	Ш	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	L	Ш	III	IV	IV
P: = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons					
M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which could impair an individual's ability to take protective	or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		N	IV	IV	IV	IV
	M	action. 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						
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 2.24 Magnetic Fields – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fringe Fields		L: N/A C:	Hazard does not extend to offsite areas	L: N/A C:
		R:		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)/y	vear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	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	e	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	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		YYY	***	***	***
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that	Ö	N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-						
Acronyms			threatening or permanently	threatening or						
MOI = Maximally-exposed Offsite Individual		individual's ability to	disabling.	permanently disabling.						
		take protective		rg.						
		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 t	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 2.25 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample 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	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	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	s	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	т .	TIT	TIT	137	IV
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-						
Acronyms			threatening or permanently	threatening or						
MOI = Maximally-exposed Offsite Individual		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 2.26 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Con	sequenc	ce Matrix", 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	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{H} = \text{situation (ev}$	*			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		· ·	vent) of minor concern	uces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	III	III	IV	IV		
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V			
likelihood)		other serious effects,		cute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-								
Acronyms		could impair an	threate	ening or permanently	threatening or								
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.								
		take protective											
		action.											
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	$C \ge Serious injury, no$								
		adverse effects.	imme	ediate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
				italization required.	hospitalization required.								
	L	Mild, transient	M	linor injuries; no	Minor injuries; no								
		adverse effects > C		spitalization > C	hospitalization > C								
	N	Consequences less		sequences less than	Consequences less than								
		than those for Low	those for	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 2.27 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample 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	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)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (even}$	*			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	T	III	III	IV	IV		
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	1111	111	1 V	1 V		
likelihood)		other serious effects,		acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV		
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-								
Acronyms		could impair an	threate	ening or permanently	threatening or								
MOI = Maximally-exposed Offsite Individual		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.	imme	ediate loss of life no	immediate loss of life no								
			pern	nanent disabilities;	permanent disabilities;								
				italization required.	hospitalization required.								
	L	Mild, transient	M	linor injuries; no	Minor injuries; no								
		adverse effects > C	ho	spitalization > C	hospitalization > C								
	N	Consequences less		sequences less than	Consequences less than								
		than those for Low	those f	For Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 2.28 Access & Egress – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	vear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (even	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)	sedu		***	***	***	***
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-			•	•	•	
Acronyms		* *	threatening or permanently	threatening or						
MOI = Maximally-exposed Offsite Individual		individual's ability to	disabling.	permanently disabling.						
		take protective	Z.	, , ,						
		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 2.29 Access & Egress – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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)/y	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						
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	$III = situation (e^{-1})$	vent) of minor concern	es	Н	I	I	II	III
BEU = 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-2 (co-located worker)	Onsite-1 (facility worker)	sednences		***			
P: = Preventive (reduce event occurrence	Н	C ≥ Irreversible,	$C \ge Prompt$ worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
likelihood)		other serious effects,	or acute injury that is	fatality or acute injury that	ŭ	N	IV	IV	IV	IV
M = Mitigative (reduces event consequences)		or symptoms which	immediately life-	is immediately life-						
Acronyms			threatening or permanently	threatening or						
MOI = Maximally-exposed Offsite Individual		individual's ability to	disabling.	permanently disabling.						
		take protective	unsue img.	pointaining answering.						
		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 2.30 Access & Egress – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)	$\mathbf{H} = \mathbf{High}$			I = situation (event) of major concern						lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (even}$	*			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	iences	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible			vent) of minimal concern		M	II	II	III	IV	
Control(s) Type		Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	Consequ	т	III	III	IV	IV	
P: = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality $C \ge Prompt$ worker			L	111	111	1 V	1 V	
		other serious effects,		icute injury that is	fatality or acute injury that	С	N	IV	IV	IV	IV	
M = Mitigative (reduces event consequences)		or symptoms which		nmediately life-	is immediately life-							
Acronyms		could impair an	threate	ening or permanently	threatening or							
MOI = Maximally-exposed Offsite Individual		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	$C \ge Serious injury, no$							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			pern	nanent disabilities;	permanent disabilities;							
	L			italization required.	hospitalization required.							
		Mild, transient	M	linor injuries; no	Minor injuries; no							
		adverse effects > C	ho	spitalization > C	hospitalization > C							
		Consequences less		sequences less than	Consequences less than							
		than those for Low	those for	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 2.31 Environmental

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P:)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Airborne		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Water		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Soil		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R: