Table 5. Summary of Baseline and Residual Risks - Linac

	Risk Tables Description	Baseline Risk	Residual Risk
5.1	Radiological – Onsite-1 Facility Worker	R: I	R: III
5.2	Radiological – Onsite-2 Co-located Worker	R: I	R: III
5.3	Radiological – MOI Offsite	R: I	R: IV
5.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
5.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
5.6	Toxic Materials – MOI Offsite	R: *	R: *
5.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: I, *	R: IV, *
5.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: I, *	R: IV, *
5.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
5.10	Electrical Energy – Onsite-1 Facility Worker	R: I, *	R: IV, *
5.11	Electrical Energy – Onsite-2 Co-located Worker	R: I, *	R: IV, *
5.12	Electrical Energy – MOI Offsite	R: *	R: *
5.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
5.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
5.15	Thermal Energy – MOI Offsite	R: *	R: *
5.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
5.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
5.18	Kinetic Energy – MOI Offsite	R: *	R: *
5.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
5.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
5.21	Potential Energy – MOI Offsite	R: *	R: *
5.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
5.23	Magnetic Fields – Onsite-2 Co-located Worker	R: I	R: III
5.24	Magnetic Fields – MOI Offsite	R: N/A	R: N/A
5.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
5.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
5.27	Other Hazards – MOI Offsite	R: *	R: *
5.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
5.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
5.30	Access & Egress – MOI Offsite	R: *	R: *
5.31	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 5.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazards: Exposure to ionizing radiation from	L: A	M – Shielding (Permanent, Movable, Penetration)	L: BEU
Radiation	beam	C: H	P/M – Radiation Safety Interlock System	C: N
		R: I	P – Enclosure Search and Secure Process	R: IV
	Exposure to ionizing radiation from klystrons		P – Operation Authorization Document	
		L: A	P – Staffing	L: A
		C: M	P – Fencing and Posting	C: N
		R: II	P – Employee Training	R: IV
			P – Procedures	
			P – Proper operation of klystron M – Shielding 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	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Contamination	Hazard: Personnel 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 activation M – Proper PPE specified in RWP 	L: EU C: L R: IV
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	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	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative R	anking)	Risk	k Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		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				A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	dneuc	M	II	II	III	IV	
Control(s) Type		Offsite (MOI)	Onsite	e-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	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)	M	25.0 rem > \mathbf{C} ≥ 5 rem	10	0 rem > C ≥ 25 rem	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV
Bold = Credited Control	L	5 rem > C		25 rem > C	25 rem > C						
Acronyms MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 5.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	Hazards: Exposure to ionizing radiation from beam	L: A C: H R: I	M – Shielding (Permanent, Movable, Penetration) P/M – Radiation Safety Interlock System P – Enclosure Search and Secure Process P – Operation Authorization Document P – Staffing	L: BEU C: N R: IV L: A
	Exposure to ionizing radiation from klystrons	L: A C: M R: II	P – Fencing and Posting P – Employee Training P – Procedures P – Proper operation of klystron M – Shielding M – ESH gallery radiation surveys	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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
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
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

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative R	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		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				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			M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsit	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	ons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	00 rem > C ≥ 25 rem	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV	
Bold = Credited Control	L	5 rem > C		25 rem > C	25 rem > C	1						
Acronyms MOI = Maximally-exposed Offsite Individual	N	0.5 rem > C		5 rem > C	5 rem > C							
rem = Roentgen equivalent man												

Table 5.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazards: Exposure to ionizing	L: A	M – Shielding (Permanent, Movable, Penetration)	L: BEU
Radiation	radiation from beam	C: H	P/M – Radiation Safety Interlock System	C: N
		R: I	P – Enclosure Search and Secure Process	R: IV
			P – Operation Authorization Document	
	Exposure to ionizing radiation from	L:N/A	P – Staffing	L: N/A
	klystrons	C:	P – Fencing and Posting	C:
		R:		R:
			Hazard does not apply to the public	
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	Hazard: Exposure from RF energy	L: A	P RF Shielding	L: BEU
Radiation – RF	above allowed limits	C: M	P ES&H periodic monitoring	C: M
		R: II	P Affected area postings	R: IV

Likelihood (L, of event)/year	Cor	sequence (C, of event)/y	ear Ris	k (R, Qualitative R	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$		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				Α	U	EU	BEU	
$\mathbf{EU} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$		L = Low		III = situation (eve	es	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)	Onsite-2 (d	co-located worker)	Onsite-1 (facility worker)	edn		TTT	***	***	TV /	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem	С	≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	100 rer	$m > C \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV	
Bold = Credited Control	L	5 rem > C	2:	5 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 5.4 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:

Chemical Hazard Consequences, derived from Figure	Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (ev	II = situation (event) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		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	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	т	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	, ons	L	111	Ш	1 V			
M = Mitigative (reduces event consequences)	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		
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level								
TLV_c = Threshold Limit Value (ceiling)													

Table 5.5 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: C: R:	See Section I Chapter 04	L: C: R:

Chemical Hazard Consequences, derived from Figure	Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	C	onsequence (C, of event))/year	Risk (R, Qualitative	Risk (R, Qualitative Ranking)			Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		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	Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		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	ences	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedne	т	TTT	TIT	IV	IV			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	1 V	1 V			
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	PAC-2 > C ≥ PAC-1	PA	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV			
Acronyms	Τ.	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$									
IDLH = Immediately Dangerous to Life and Health	N	Consequences less	Cor	nsequences less than	Consequences less than									
MOI = Maximally-exposed Offsite Individual	14	*		•	•									
PAC = Protective Action Criteria		than those for Low	tnose	for Low Consequence	those for Low									
PEL = Permissible Exposure Limit		Consequence Level		Level	Consequence Level									
TLV _c = Threshold Limit Value (ceiling)														

Table 5.6 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:

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							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = 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	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	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	т	TIT	III	IV	IV		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	111	1 V	1 V		
M = Mitigative (reduces event consequences)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV _c = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level								

 ${\bf Table~5.7~Flammable~and~Combustible~Materials-Onsite~-1~Facility~Worker}$

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	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk	Matri	ix								
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (event) of major concern					Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for 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	nces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	TIT	13.7	TS 7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which		nmediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening or permanently	threatening or								
		individual's ability to		disabling.	permanently disabling.								
		take protective		-									
		action.											
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	imme	ediate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no								
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$								
	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 5.8 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	, "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							
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	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	- E	M	П	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV	
Acronyms		or symptoms which		nmediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ening or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		-								
		action.										
	M	$C \ge Mild$, transient	C ≥ 3	Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
			hospit	italization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$							
	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 5.9 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										
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (expression of the situation of the sit	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)	sedne	_	TTT	TIT	17.7	13.7
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)	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	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	1					
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences less than	Consequences less than	1					
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.10 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:IV
			M – Overcurrent protection	

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.							
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk	Matri	ix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for 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	nces	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	П	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedu	_	TTT	TIT	13.7	TS 7	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV	
Acronyms		or symptoms which		nmediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		-								
		action.										
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	imme	ediate 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 $> \mathbf{C}$							
	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 5.11 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
		C:H	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:IV

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I =	`	nt) of major concern	Risk	Matri			lihood	2577	
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)		$\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	III	= situation (ev	ent) of concern vent) of minor concern vent) of minimal concern	suces	Н	I II	I II	EU II	BEU III IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-loca $C \ge \text{Prompt wo}$	orker fatality	Onsite-1 (facility worker) C ≥ Prompt worker	Consequences	L	III	III	IV	IV	
 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 inju immediate threatening or J disabli	ely life- permanently	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 immediate los permanent di hospitalizatio	s of life no isabilities; n required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.							
	L	Mild, transient adverse effects > C	Minor inju hospitaliza	tion > C	Minor injuries; no hospitalization > C							
	N	Consequences less than those for Low Consequence Level	Consequence those for Low (Leve	Consequence	Consequences less than those for Low Consequence Level							

Table 5.12 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	l, "F	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	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)		$\mathbf{L} = \mathbf{Low}$	$\mathbf{III} = \text{situation (ev}$	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	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedne	_	TIT	TIT	17.7	13.7
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)	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-					•	<u> </u>
MOI = Maximally-exposed Offsite Individual		_	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	J							
		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 $> \mathbf{C}$						
	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 5.13 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	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High		Ranking) nt) of major concern	Risk	Matri			lihood	
$\mathbf{U} = \text{Unlikely } (1.0\text{E}-02 > \text{L} > 1.0\text{E}-04)$ $\mathbf{E}\mathbf{U} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ $\mathbf{B}\mathbf{E}\mathbf{U} = \text{Beyond Extremely Unlikely } (1.0\text{E}-06 > \text{L})$		$\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	suces	H M	I II	I I	EU II	BEU III IV
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) C ≥ Prompt worker	Consequences	L	III	III	IV	IV
 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 hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 5.14 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: C:	See Section I Chapter 04	L: C:
		R:		R:
Hot work		L: C: R:	See Section I Chapter 04	L: C: R:
Cryogenics		L: C: R:	See Section I Chapter 04	L: C: R:

eversible, $C \ge F$	I = situation (everall in the situation (eve	nt) of major concern	Risk	H M	A I	U I	ihood EU II	BEU III
gligible e (MOI) eversible, $C \ge I$	III = situation (ev IV = situation (ev te-2 (co-located worker)	vent) of minor concern vent) of minimal concern	lnences		I	I		
eversible, $C \ge F$		Onsite-1 (facility worker)	1 2		11	II	III	IV
oms which	•	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Conseq	L N	III IV	III IV	IV IV	IV IV
d, transient e effects. imm per hoss transient effects > C h nences less Con	mediate loss of life no rmanent disabilities; spitalization required. Minor injuries; no hospitalization > C onsequences less than	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low						
tre tre s	oms which mpair an s ability to otective ion. , transient effects. cransient ffects > C ences less oms which threa threa characteristics threa threa characteristics threa t	immediately life- threatening or permanently disabling. C≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C ences less e for Low immediately life- threatening or permanently disabling. C≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Consequences less than those for Low Consequence	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	immediately lifethreatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Ences less C onsequences less than those for Low immediately lifethreatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low	immediately lifethreatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization $>$ C immediateloss of life no permanent disabilities; hospitalization $>$ C immediateloss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization $>$ C immediateloss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization $>$ C immediateloss of life no permanent disabilities; hospitalization required. Consequences less than those for Low Consequence liss than those for Low	oms which immediately life-threatening or permanently disabling. Solitive ion. The reflects. The reflects immediately life-threatening or permanently disabling. The reflects is immediately life-threatening or permanently disabling.	immediately life- threatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C ences less e for Low immediately life- threatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Consequences less than those for Low C \geq Serious injury, no immediately life- threatening or permanently disabling. C \geq Serious injury, no immediately life- threatening or permanently disabling.	immediately life- threatening or permanently disabling. C \geq Serious injury, no effects. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C ences less e for Low immediately life- threatening or permanently disabling. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. C \geq Serious injury, no immediate loss of life no permanent disabilities; hospitalization \geq C Consequences less than those for Low

Table 5.15 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	l, "F	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nation (event) 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			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (expression of the situation of the sit	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)	sedne	_	TIT	TIT	17.7	13.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that)	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-					•	
MOI = Maximally-exposed Offsite Individual		could impair an	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 $> \mathbf{C}$						
	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 5.16 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:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Motion Tables		L:	See Section I Chapter 04	L:
Wiotion 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, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High		Ranking) nt) of major concern	Risk	Matri			lihood	
$\mathbf{U} = \text{Unlikely } (1.0\text{E}-02 > \text{L} > 1.0\text{E}-04)$ $\mathbf{E}\mathbf{U} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ $\mathbf{B}\mathbf{E}\mathbf{U} = \text{Beyond Extremely Unlikely } (1.0\text{E}-06 > \text{L})$		$\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	suces	H M	I II	I I	EU II	BEU III IV
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) C ≥ Prompt worker	Consequences	L	III	III	IV	IV
 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 hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 5.17 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) U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		$\mathbf{H} = \mathrm{High}$ $\mathbf{M} = \mathrm{Moderate}$ $\mathbf{L} = \mathrm{Low}$		I = situation (eve	ituation (event) of major concern			Likelihood			
				\mathbf{II} = situation (event) of concern			1	A	U	EU	BEU
				III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N} = \text{Negligible}$		IV = situation (event) of minimal concern			M	II	II	III	IV
Control(s) Type		Offsite (MOI)	Offsite (MOI) Onsite-2 (co-located worker) Onsite-1 (facility worker)	nbəs	Ι.	Ш	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.	Com	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 manent 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 5.18 Kinetic Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	l, "F	Example 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						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	nt) of major concern							
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 (ev	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		M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	Ι.	Ш	III	IV	IV	
 P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual 	H	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 manent 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 5.19 Potential 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:	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	, "E	xample Qualitative Con	sequence Matrix", DO	E-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year Risk (R, Qualit	ative 1	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation	n (evei	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation}$	on (eve	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situati	ion (ev	vent) of minor concern	uces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situati	ion (ev	vent) of minimal concern	I I 53	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located world	ker)	Onsite-1 (facility worker)	nbəs	,	***	***	77.7	77.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fata	ality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that i	•	fatality or acute injury that	ت ا	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-		is immediately life-			•	•	•	<u> </u>		
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permane	ently	threatening or								
		individual's ability to	disabling.	Ĭ	permanently disabling.								
		take protective	•										
		action.											
	M	C ≥ Mild, transient	C ≥ Serious injury, r	10	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life	no	immediate loss of life no								
			permanent disabilitie	es;	permanent disabilities;								
			hospitalization require	ed.	hospitalization required.								
	L	Mild, transient	Minor injuries; no		Minor injuries; no								
		adverse effects > C	hospitalization > C	,	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less th	an	Consequences less than								
		than those for Low	those for Low Consequ	ence	those for Low								
		Consequence Level	Level		Consequence Level								

Table 5.20 Potential 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: C:	See Section I Chapter 04	L: C:
Compressed Gasses		R: L: C: R:	See Section I Chapter 04	R: L: C: R:
Vacuum/ Pressure Vessels/Piping		L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum Pumps		L: C: R:	See Section I Chapter 04	L: C: R:
Material Handling		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equence Matrix", DOE-HD	DBK-1163-2020.							
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I = situation (eve	ent) of major concern	Risk	Matri		Likelihood			
$\mathbf{U} = \text{Unlikely } (1.0\text{E}-02 > \text{L} > 1.0\text{E}-04)$ $\mathbf{E}\mathbf{U} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ $\mathbf{B}\mathbf{E}\mathbf{U} = \text{Beyond Extremely Unlikely } (1.0\text{E}-06 > \text{L})$		$\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$		vent) of concern vent) of minor concern vent) of minimal concern	sednences	Н	I II	I I	II	BEU III IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	C H	Offsite (MOI) $C \ge Irreversible,$	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) C ≥ Prompt worker	Conseque	L	III	III	IV IV	IV IV	
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.		11	14	1 1	11	14	
	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 those for Low Consequence Level	Consequences less than those for Low Consequence Level							

 $Table \ 5.21 \ Potential \ Energy-MOI \ Offsite$

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

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	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					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	vent) 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	nces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedu	_	TTT	TIT	13.7	TS 7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV		
Acronyms		or symptoms which		nmediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening 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.	imme	ediate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no								
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$								
	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 5.22 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	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (evolution)	event) of concern		ı	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	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)	sedneuces	_	***	***	77.7	***
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > P	Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which		mmediately life-	is immediately life-	-				•	
MOI = Maximally-exposed Offsite Individual		could impair an		tening 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.	imm	ediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
	L	Mild, transient	N	Minor injuries; no	Minor injuries; no						
		adverse effects $> \mathbf{C}$	h	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cor	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 5.23 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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Con	sequen	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	vent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (evaluation)	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-	2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	TTT	777	13.7	137		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which		nmediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		ening 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.	imme	ediate loss of life no	immediate loss of life no								
			pern	nanent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	M	linor injuries; no	Minor injuries; no								
		adverse effects $> C$	ho	spitalization > C	hospitalization $> \mathbf{C}$								
	Ν	Consequences less	Cons	sequences less than	Consequences less than								
		than those for Low	those f	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 5.24 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 apply to the public.	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	Co	onsequence (C, of event)/y	vear Risk (R, Qualitative	Ranking)	Risk	Matri	X					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (eve}$	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (evolution (evolution)}$	ent) of concern		ı	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	s	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-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	_	***	***	77.7	***		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	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	S	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	J									
		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 5.25 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:
Working at Heights		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					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	vent) of concern		ı	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	န္	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	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	_	***	777	77.7	77.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Coms	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	ŭ	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	2									
		action.										
	M	$C \ge Mild$, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects $> \mathbf{C}$	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 5.26 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:
Working at Heights		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 I	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (even}$	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	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	iences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	T	III	III	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V	1 V
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,		cute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threaten	ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective									
		action.									
	M	$C \ge Mild$, transient	$\mathbf{C} \geq \mathbf{S}$	Serious injury, no	$C \ge Serious injury, no$						
		adverse effects.	immed	diate loss of life no	immediate loss of life no						
			perma	anent disabilities;	permanent disabilities;						
				talization required.	hospitalization required.						
	L	Mild, transient		nor injuries; no	Minor injuries; no						
		adverse effects > C		spitalization > C	hospitalization > C						
	N	Consequences less		equences less than	Consequences less than						
			those for	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 5.27 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:
Working at Heights		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 I	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (evo	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	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	TIT	13.7	TS 7
P = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threaten	ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective									
		action.									
	M	$C \ge Mild$, transient	$\mathbf{C} \geq \mathbf{S}$	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immed	diate loss of life no	immediate loss of life no						
			perma	anent disabilities;	permanent disabilities;						
			hospita	alization required.	hospitalization required.						
	\mathbf{L}	Mild, transient	Mii	nor injuries; no	Minor injuries; no						
		adverse effects > C	hosp	pitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those for	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 5.28 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, "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					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (even}$	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (even}$	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situation (evolution)	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-2 (co-located worker)	Onsite-1 (facility worker)	Consequences		TTT	TTT	13.7	13.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	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	5	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	<u> </u>									
		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 $> \mathbf{C}$								
	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 5.29 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	l, "E	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	ear Risk (R, Qualitative	Ranking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (even}$	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (evolution)	vent) of minor concern	se	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (evolution)	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)	Consequences	,	777	111	13.7	TX 7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ous	L	III	III	IV	IV
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	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.						
	\mathbf{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						
			hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.30 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					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$	$\mathbf{H} = \mathbf{High}$ $\mathbf{M} = \mathbf{Moderate}$			I = situation (event) of major concern					Likelihood			
U = Unlikely (1.0E-02> L > 1.0E-04)				\mathbf{II} = situation (evo	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	ences	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	П	II	III	IV	
Control(s) Type	<u>С</u>	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	TIT	13.7	TS 7	
P = Preventive (reduce event occurrence likelihood)		C ≥ Irreversible,	C ≥ Prompt worker fatality		C ≥ Prompt worker	Cons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences) Acronyms		other serious effects,		cute injury that is	fatality or acute injury that		N	IV	IV	IV	IV	
		or symptoms which		nmediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		-								
		action.										
	M L N	C ≥ Mild, transient	C ≥ 3	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;							
			hospit	talization required.	hospitalization required.							
		Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$							
		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 5.31 Environmental

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