Table 8. Summary of Baseline and Residual Risks – Booster

	Risk Tables Description	Baseline Risk	Residual Risk
8.1	Radiological – Onsite-1 Facility Worker	R: I	R: III, IV
8.2	Radiological – Onsite-2 Co-located Worker	R: I	R: III, IV
8.3	Radiological – MOI Offsite	R: I	R: IV
8.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
8.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
8.6	Toxic Materials – MOI Offsite	R: *	R: *
8.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *
8.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *
8.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
8.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *
8.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *
8.12	Electrical Energy – MOI Offsite	R: *	R: *
8.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
8.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
8.15	Thermal Energy – MOI Offsite	R: *	R: *
8.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
8.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
8.18	Kinetic Energy – MOI Offsite	R: *	R: *
8.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
8.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
8.21	Potential Energy – MOI Offsite	R: *	R: *
8.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
8.23	Magnetic Fields – Onsite-2 Co-located Worker	R: I	R: III
8.24	Magnetic Fields – MOI Offsite	R: N/A	R: N/A
8.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
8.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
8.27	Other Hazards – MOI Offsite	R: *	R: *
8.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
8.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
8.30	Access & Egress – MOI Offsite	R: *	R: *
8.31	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 8.1 Radiological – Onsite-1 Facility Worker

Hazard Hazard Description		Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: A C: H R: I	M – Shielding to reduce activation M – Proper dosimetry P – Employee Rad Worker training P – ALARA plan	L: EU C: L R: IV
Groundwater Activation	Hazard: Potential exposure due to construction activities, (e.g., earthmoving).	L: A C: N R: IV	 P – Sump water is evaluated to determine the presence of tritium or other activation products to prevent personnel exposure. P – Lift stations capture potentially activated water to prevent releases exceeding allowed discharge limits. M – Facility designs employ shielding to mitigate the production of activation products in groundwater. 	L: EU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazards: Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	P – Beam loss monitors (in enclosures) prevent excessive beam loss. M – Radiation Detectors (in enclosures and berms) reduce the amount of activation to surface water, by promptly disabling the beam. M – Shielding (soil, concrete, and/or steel) reduces surface water activation.	L: U C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	 P – Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard. P – Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard. M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved. M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard. 	L: EU C: N R: IV
Radioactive Waste	Hazard: Radiation exposure	L: A C: H R: I	M – Shielding to reduce generation of waste M – Material survey and release process P – Postings P – Beam tuned to reduce generation of waste	L: EU C: L R: IV
Contamination	Hazard: Personnel exposure	L: A C: H R: I	M – Shielding to reduce activation M – Proper PPE specified in RWP P – Radiological controls personnel survey and decontamination P – Postings place in the event contamination is identified	L: EU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
⁷ Be	Hazard: Uptake of ⁷ Be	L: A C: N R: IV	Not applicable. No prevention or mitigation is required. 7Be isn't hazardous in this pattern of use by facility.	L: A C: N 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	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	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative R	(anking)	Risk	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)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (even	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ence	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 likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	Suo	L	III	III	IV	IV
$\mathbf{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	С	N	IV	IV	IV	IV
Acronyms	L	5 rem > C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 8.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: A C: H R: I	M – Shielding to reduce activation M – Proper dosimetry P – Employee Rad Worker training P – ALARA plan	L: EU C: L R: IV
Groundwater Activation	Hazard: Potential exposure due to construction activities, (e.g., earthmoving).	L: A C: N R: IV	 P – Sump water is evaluated to determine the presence of tritium or other activation products to prevent personnel exposure. P – Lift stations capture potentially activated water to prevent releases exceeding allowed discharge limits. M – Facility designs employ shielding to mitigate the production of activation products in groundwater. 	L: EU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazards: Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	 P – Beam loss monitors (in enclosures) prevent excessive beam loss. M – Radiation Detectors (in enclosures and berms) reduce the amount of activation to surface water, by promptly disabling the beam. M – Shielding (soil, concrete, and/or steel) reduces surface water activation. 	L: U C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	 P – Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard. P – Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard. M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved. M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard. 	L: EU C: N R: IV
Radioactive Waste	Hazard: Radiation exposure	L: A C: H R: I	M – Shielding to reduce generation of waste M – Material survey and release process P – Postings P – Beam tuned to reduce generation of waste	L: EU C: L R: IV
Contamination	Hazard: Radiation exposure	L: A C: H R: I	M – Shielding to reduce activation M – Proper PPE specified in RWP P – Radiological controls personnel survey and decontamination P – Postings place in the event contamination is identified	L: EU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
⁷ Be	Hazard: Uptake of ⁷ Be	L: A C: N R: IV	Not applicable. No prevention or mitigation is required. ⁷ Be isn't hazardous in this pattern of use by facility.	L: A C: N R: IV
Non-ionizing radiation-Laser	Hazards: Exposure to Class 3B and 4 lasers Exposure to Class 3R lasers	L: A C: H R: I L: A C: L	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 No analysis required	L: BEU C: H R: IV L: A C: L R: III
	Exposure to Class 1 and 2 Lasers	R: III 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	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative R	(anking)	Risk	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)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (even	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ence	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 likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	Suo	L	III	III	IV	IV
$\mathbf{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	С	N	IV	IV	IV	IV
Acronyms	L	5 rem > C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 8.3 Radiological – MOI Offsite

Hazard	Hazard Description		Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: N/A C: R:	Hazard does not apply to the public	L: N/A C: R:
Groundwater Activation	Hazard: Potential contamination of drinking water.	L: U C: N R: IV	 P – Monitoring groundwater near beam enclosures in the sump pit system to prevent release into downstream sources. P – monitoring wells (Class II groundwater) prevent exceeding limits imposed for tritium migration into Class I groundwater. P – Monitoring Class 1 water onsite to prevent exposure to public prior to releasing water to Class I offsite sources. M – Monitor Class 1 water to assure that activation products remain below allowed limits to public (non-degradation limit, State of Illinois). 	L: BEU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazards: Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	 P – Beam loss monitors (in enclosures) prevent excessive beam loss. M – Radiation Detectors (in enclosures and berms) reduce the amount of activation to surface water, by promptly disabling the beam. M – Shielding (soil, concrete, and/or steel) reduces surface water activation. 	L: U C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	 P – Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard. P –Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard. M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved. M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard. 	L: EU C: N R: IV
Radioactive Waste	Hazard: Radiation exposure	L: N/A C: R:	Hazard does not apply to the public	L: N/A C: R:
Contamination	Hazard: Radiation exposure	L: N/A C: R:	Hazard does not apply to the public	L: N/A C: R:
⁷ Be	Hazard: Uptake of ⁷ Be	L: A C: N R: IV	Hazard does not apply to the public	L: A C: N R: IV
Non-ionizing Radiation Hazards	Hazard: <mark>N/A</mark>	L: C: R:		L: C: R:

Radiological Hazard Consequences, derived from Figu	re C	-1, "Example Qualitativ	e Con	sequence Matrix", DO	E-HDBK-1163-2020.						
Likelihood (L, of event)/year	kelihood (L, of event)/year Consequence (C, of event)/year Risk (R, Qualitative Ranking)										
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		I = situation (even	t) of major concern			Likelihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (eve	nt) of concern			Α	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	ent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	nba		***	***	***	***
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	Suox	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
Acronyms MOI - Movimelly, averaged Offsite Individual	L	5 rem > C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 8.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		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	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event))/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
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			Α	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	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn		777	777	IV	13.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	0	N	IV	IV	IV	IV
Acronyms	T.	PAC-1 > C		$\frac{PAC-2 > C}{PAC-2 > C}$	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	1	than those for Low		for Low Consequence	those for Low						
PAC = Protective Action Criteria		Consequence Level	tilose	Level	Consequence Level						
PEL = Permissible Exposure Limit		Consequence Level		LCVCI	Consequence Lever						
TLV_c = Threshold Limit Value (ceiling)											

Table 8.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		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	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event))/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
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	_		Α	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 (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	_	TTT	777	IV	13.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	IV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	0	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	N	Consequences less	Cor	nsequences less than	Consequences less than						
MOI = Maximally-exposed Offsite Individual	• `	than those for Low		for Low Consequence	those for Low						
PAC = Protective Action Criteria		Consequence Level	those	Level	Consequence Level						
PEL = Permissible Exposure Limit		Consequence Level		LCVCI	Consequence Lever						
TLV_c = Threshold Limit Value (ceiling)											

Table 8.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	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								
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	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	т т	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C≥IDLH	suo;	L	111	Ш	1 V	1 V		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	PAC-2 > C ≥ 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	N	Consequences less	Cor	nsequences less than	Consequences less than								
MOI = Maximally-exposed Offsite Individual	Γ'	than those for Low		for Low Consequence	those for Low								
PAC = Protective Action Criteria			uiosc	Level									
PEL = Permissible Exposure Limit		Consequence Level		Level	Consequence Level								
TLV_c = Threshold Limit Value (ceiling)													

 ${\bf Table~8.7~Flammable~and~Combustible~Materials-Onsite~-1~Facility~Worker}$

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable		L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R		R
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk	Matri	ix						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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 vent) of minimal concern	nces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev			M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	sedu		***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	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						
			pern	nanent disabilities;	permanent disabilities;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable		L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R		R
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk	Matri	ix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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 vent) of minimal concern	nces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev		- E	M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		L:	See Section I Chapter 04	L:
materials (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				
Flammable		L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R		R
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix										
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (even	ent) of concern			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	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	(co-located worker)	Onsite-1 (facility worker)	sedu		***	***	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	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	$C \ge S$	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;								
			hospit	alization required.	hospitalization required.								
	L	Mild, transient	Mi	nor injuries; no	Minor injuries; no								
		adverse effects $> \mathbf{C}$ hosp		pitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less Conseq		Consequences less than								
		than those for Low	those for	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 8.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		R:		R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix										
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = 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			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	(co-located worker)	Onsite-1 (facility worker)	sedu	_	***	***	77.7	77.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Proi	mpt 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		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	$C \ge S$	Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immedi	liate loss of life no	immediate loss of life no								
			perma	anent disabilities;	permanent disabilities;								
			hospita	alization required.	hospitalization required.								
	L	Mild, transient	Min	nor injuries; no	Minor injuries; no								
		adverse effects > C	hosp	pitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less Conseq		Consequences less than								
		than those for Low	those for	r Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

 Table 8.11 Electrical Energy 1 Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		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 Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	event) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (expression of the situation of the sit	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	_	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		
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	၂၂၁	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-				•	•			
MOI = Maximally-exposed Offsite Individual		_	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	C									
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$								
	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								

 $Table \ 8.12 \ Electrical \ Energy-MOI \ Offsite$

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		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 Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	event) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (expression of the situation of the sit	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	_	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		
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	၂၂၁	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-				•	•			
MOI = Maximally-exposed Offsite Individual		_	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	C									
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$								
	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 8.13 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	sequen	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix										
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$		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 $	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	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	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	٥	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								
			pern	nanent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no								
		adverse effects $> \mathbf{C}$ hosp		ospitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less Conseq		Consequences less than								
		than those for Low	those f	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 8.14 Thermal Energy – Onsite-2 Co-located Worker

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

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 Matrix										
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	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	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	TX /		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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								
			perm	nanent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	M	linor injuries; no	Minor injuries; no	1							
		adverse effects $> \mathbf{C}$ hosp		spitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less Conseq		Consequences less than								
		than those for Low	those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 8.15 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking)			Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$	$\mathbf{H} = \mathbf{High}$			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 vent) of minor concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev		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	П	II	III	IV		
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7		
	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is immediately life-		fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which			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 L	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.								
		Mild, transient	M	linor injuries; no	Minor injuries; no								
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$								
	N	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 8.16 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools		L:	See Section I Chapter 04	L:
101101		C:		C:
		R:		R:
Motion Tables		L:	See Section I Chapter 04	L:
		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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.														
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	R, Qualitative Ranking)				Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) of major concern				Likelihood						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern			Α	U	EU	BEU				
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	$\mathbf{III} = \text{situation (e}$	vent) of minor concern	sə	Н	I	I	II	III				
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (evolution)	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				
$\mathbf{M} = \mathbf{Mitigative}$ (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		could impair an	threatening or permanently	threatening or										
		individual's ability to	disabling.	permanently disabling.										
		take protective	C											
	M L	action.												
		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.										
		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 8.17 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools		L:	See Section I Chapter 04	L:
10110110015		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	l, "E	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.							
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern							
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern		1	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	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	ī	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.	Cons	N	IV	IV	IV	IV	
	M L	$C \ge Mild$, transient $C \ge S$ adverse effects. immed perm hospit $Mild$, transient Mi		≥ 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 8.18 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	l, "F	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						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) 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	vent) of minor concern	seou	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	ī	III	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.	Cons	N	IV	IV	IV	IV	
	M L	I $C \ge Mild$, transient $C \ge Mild$ immediately adverse effects. immediately hospital Mild, transient Mild.		≥ 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 8.19 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		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:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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 (co-located worker)	Onsite-1 (facility worker)	sedu		***	777	77.7	77.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	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								
			pern	nanent disabilities;	permanent disabilities;								
			hosp	italization required.	hospitalization required.								
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no								
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$								
	N	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~8.20~Potential~Energy-Onsite-2~Co-located~Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		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:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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	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	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	TIT	13.7	TX /
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.21 Potential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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:

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				Like	lihood	
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	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	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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						
	a		ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.22 Magnetic Fields – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	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								
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Likelihood							
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{II} = situation (event) of concern				A	U	EU	BEU					
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (evaluation	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	-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	***	***	***	77.7					
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > P	rompt worker fatality	C ≥ Prompt worker		L	III	III	IV	IV					
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	Co	N	IV	IV	IV	IV					
Acronyms		or symptoms which		mmediately 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		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;											
			hospit		hospitalization required.											
	L	Mild, transient M		Inor injuries; no	Minor injuries; no											
		adverse effects $> \mathbb{C}$ ho		ospitalization > C	hospitalization $> \mathbf{C}$											
	N	Consequences less Conse		sequences less than	Consequences less than											
		than those for Low	those f	for Low Consequence	those for Low											
		Consequence Level		Level	Consequence Level											

Table 8.23 Magnetic Fields – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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 RWP.	C: H
		R: I	P – Postings of magnetic field hazard at entry points.	R: III

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			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	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)	nba	,	***	***	77.7	***
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > P1	rompt worker fatality	C ≥ Prompt worker	suo	L	III	III	IV	IV
M = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	Co	N	IV	IV	IV	IV
Acronyms				mmediately 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		C							
		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						
			perr	manent disabilities;	permanent disabilities;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N Consequence		Con	sequences less than	Consequences less than						
		than those for Low	those f	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 8.24 Magnetic Fields – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fringe Fields	Hazard: Fringe fields causing heart pacemaker malfunction	L: N/A C: R:	Hazard does not extend to offsite areas	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)/y	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				lihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = situation (evolution (evolution for evolution (evolution for evolution for evolution for evolution (evolution for evolution for ev$	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	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	,	777	***	***	***		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		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								

 $Table\ 8.25\ Other\ hazards-Onsite-1\ Facility\ Worker$

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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 (co-located worker)	Onsite-1 (facility worker)	sedu		***	777	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		other serious effects, or symptoms which	immediately life- threatening or permanently		is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an			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						
			pern	nanent disabilities;	permanent disabilities;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.26 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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 (co-located worker)	Onsite-1 (facility worker)	sedu		***	777	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		other serious effects, or symptoms which	immediately life- threatening or permanently		is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an			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						
			pern	nanent disabilities;	permanent disabilities;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.27 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	event) of concern event) of minor concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev		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	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	TIT	13.7	TX /
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt 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	immediately life- threatening or permanently		is immediately life-			•	•	•	
MOI = Maximally-exposed Offsite Individual		could impair an			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	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.28 Access & Egress – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (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 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	777	13.7	TX /
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	٥	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life- threatening or permanently		is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an			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						
			pern	nanent disabilities;	permanent disabilities;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	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 8.29 Access & Egress – Onsite-2 Co-located Worker

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

Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking) Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathrm{High}$	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 (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)	nsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***		***	***
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	C	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-					•	
MOI = Maximally-exposed Offsite Individual		• •	reatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	· ·							
		action.								
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects > C	hospitalization > C	hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
		than those for Low that	ose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 8.30 Access & Egress – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (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)/	year Risk (R, Qualitative	isk (R, Qualitative Ranking)			Risk Matrix				
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	n (event) of major concern				Likelihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (even}$	ent) of concern	_		A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	$\mathbf{III} = \text{situation (ev}$	vent) of minor concern	seau	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ē	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 likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	111	111	1 V	1 V	
M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		other serious effects,	or acute injury that is immediately life-	fatality or acute injury that is immediately life-threatening or	$^{\circ}$	N	IV	IV	IV	IV	
		or symptoms which									
		could impair an	threatening or permanently								
		individual's ability to	disabling.	permanently disabling.							
		take protective									
		action.									
	M	$C \ge Mild$, transient	$C \ge Serious injury, no$	$C \ge$ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$							
		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 8.31 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:
Water		R:	Cas Section I Chapter 04	R:
water		L: C: R:	See Section I Chapter 04	L: C: R:
Soil		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R: