Table 2. Summary of Baseline and Residual Risks – Booster

	Risk Tables Description	Baseline	Residual
		Risk	Risk
2.1	Radiological – Onsite-1 Facility Worker	R: I	R: III, IV
2.2	Radiological – Onsite-2 Co-located Worker	R: I	R: III, IV
2.3	Radiological – MOI Offsite	R: I	R: IV
2.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
2.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
2.6	Toxic Materials – MOI Offsite	R: *	R: *
2.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *
2.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *
2.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
2.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *
2.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *
2.12	Electrical Energy – MOI Offsite	R: *	R: *
2.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
2.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
2.15	Thermal Energy – MOI Offsite	R: *	R: *
2.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
2.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
2.18	Kinetic Energy – MOI Offsite	R: *	R: *
2.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
2.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
2.21	Potential Energy – MOI Offsite	R: *	R: *
2.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
2.23	Magnetic Fields – Onsite-2 Co-located Worker	R: I	R: III
2.24	Magnetic Fields – MOI Offsite	R: N/A	R: N/A
2.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
2.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
2.27	Other Hazards – MOI Offsite	R: *	R: *
2.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
2.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
2.30	Access & Egress – MOI Offsite	R: *	R: *
2.31	Environmental Hazards	R: *	R: *

<sup>\*</sup> This hazard has been evaluated within the common Risk Matrix table included in SAD Section I Chapter 04 Safety Analysis. Work in the specified areas involving this hazard implements the controls specified in the common Risk Matrix table. No unique controls are in use.

## NOTE

Per DOE-HDBK-1163-2020, Appendix C, "Risk Assessment Methodology":

"Events with an unmitigated risk value of III or IV would not require additional control assignments to provide reasonable assurance of adequate protection. Whereas, for events with an unmitigated risk value of I or II, controls would need to be assigned to either reduce the likelihood or the consequence, and therefore the overall mitigated risk. Generally, preventive controls are applied prior to a loss event – reflecting a likelihood reduction and mitigative controls are applied after a loss event – reflecting a consequence reduction. Each control is credited for a single "bin drop" either in likelihood or consequence; not both. Following a standard hierarchy of controls, controls are applied until the residual risk is acceptable – reflecting a mitigated risk value of III or IV. After controls are credited, events with a remaining unacceptable residual risk (i.e., I or II) are candidates for additional analyses and additional controls, often quantitative in nature." For Fermilab, these controls for accelerator-specific hazards are identified as Credited Controls and further summarized in the Accelerator Safety Envelope (ASE).

Table 2.1 Radiological – Onsite-1 Facility Worker

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

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	<ul> <li>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.</li> <li>P – Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved.</li> <li>M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	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)
<sup>7</sup> Be	Hazard: Uptake of <sup>7</sup> 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	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	anking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə					
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	100	$0 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem	0	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 > <b>C</b>		5 rem > C	5 rem > C						

Table 2.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description		Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazard: Exposure to ionization	L: A	M – Shielding	L: BEU
Radiation	radiation	C: H	P – Interlocked beam loss detectors	C: M
		R: I	P – Employee Rad Worker training	R: IV
Residual	Hazard: Radiation exposure	L: A	M – Shielding to reduce activation	L: EU
Activation		C: H	M – Proper dosimetry	C: L
		R: I	P – Employee Rad Worker training	R: IV
			P – ALARA plan	
Groundwater	Hazard: Potential exposure due to	L: A	P – Sump water is evaluated to determine the presence of tritium or other	L: EU
Activation	construction activities, (e.g.,	C: N	activation products to prevent personnel exposure.	C: N
	earthmoving).	R: IV	P – Lift stations capture potentially activated water to prevent releases exceeding allowed discharge limits.	R: IV
			M – Facility designs employ shielding to mitigate the production of activation products in groundwater.	

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	<ul> <li>P – Beam loss monitors (in enclosures) prevent excessive beam loss.</li> <li>M – Radiation Detectors (in enclosures and berms) reduce the amount of activation to surface water, by promptly disabling the beam.</li> <li>M – Shielding (soil, concrete, and/or steel) reduces surface water activation.</li> </ul>	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	<ul> <li>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.</li> <li>P – Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved.</li> <li>M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	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)
<sup>7</sup> Be	Hazard: Uptake of <sup>7</sup> 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  Exposure to Class 3R 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  No analysis required	L: BEU C: H R: IV L: A C: L
	Exposure to Class 1 and 2 Lasers	C: L R: III L: A C: N R: IV	No analysis required	R: III  L: A C: N R: IV
Non-ionizing radiation-RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P – RF Shielding P – ES&H periodic monitoring P – LOTO procedure performed by facility worker P – Affected area postings	L: BEU C: M R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix				X					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***	***	***	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	100	rem > C ≥ 25 rem	100 rem > C ≥ 25 rem	0	N	IV	IV	IV	IV
Acronyms	L	5 rem > <b>C</b>		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > C						

**Table 2.3 Radiological – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazard: Exposure to ionization	L: A	M – Shielding	L: BEU
Radiation	radiation	C: H	P – Interlocked beam loss detectors	C: M
		R: I	P – Interlocked doors	R: IV
Residual	Hazard: Radiation exposure	L: N/A	Hazard does not apply to the public	L: N/A
Activation		C:		C:
		R:		R:
Groundwater	Hazard: Potential contamination of	L: U	P – Monitoring groundwater near beam enclosures in the sump pit system	L: BEU
Activation	drinking water.	C: N	to prevent release into downstream sources.	C: N
		R: IV	P – monitoring wells (Class II groundwater) prevent exceeding limits imposed for tritium migration into Class I groundwater.	R: IV
			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).	

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	<ul> <li>P – Beam loss monitors (in enclosures) prevent excessive beam loss.</li> <li>M – Radiation Detectors (in enclosures and berms) reduce the amount of activation to surface water, by promptly disabling the beam.</li> <li>M – Shielding (soil, concrete, and/or steel) reduces surface water activation.</li> </ul>	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	<ul> <li>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.</li> <li>P –Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – In situations where surface water activation is higher than expected (discovered by monitoring), facility stops operation until facility upset condition is resolved.</li> <li>M – Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	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:
<sup>7</sup> Be	Hazard: Uptake of <sup>7</sup> 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: N/A	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	Co	nsequence (C, of event)/	year	Risk (R, Qualitative F	Ranking)	Risk	Matri	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even)	t) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		<b>IV</b> = situation (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)	edno	_	TTT	TTT	77.7	TX 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem	ons	L	111	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbb{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV
Acronyms  MOI - Movimelly, averaged Offsite Individual	L	5 rem > <b>C</b>		25 rem > <b>C</b>	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > C						

**Table 2.4 Toxic Materials – Onsite 1 Facility Worker** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		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	Consec	quence Matrix", DOE-	HDBK-1163-2020.							
Likelihood (L, of event)/year	C	onsequence (C, of event	)/year	Risk (R, Qualitative	Ranking)	R	isk N	<b>Iatri</b>	K			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		<b>I</b> = situation (eve	nt) of major concern					Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern	l —			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	8	ß	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern			M	II	II	Ш	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)		nha ⊢	т	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH			L	111	111	1 V	- '
<b>M</b> = 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 > <b>C</b>		PAC-2 > C	PEL or $TLV_c > C$							
IDLH = Immediately Dangerous to Life and Health	N	Consequences less	Cot	nsequences less than	Consequences less than							
<b>MOI</b> = Maximally-exposed Offsite Individual	,	than those for Low		for Low Consequence	those for Low							
<b>PAC</b> = Protective Action Criteria		Consequence Level	uiosc	Level	Consequence Level							
<b>PEL</b> = Permissible Exposure Limit		Consequence Level		LEVEI	Consequence Level							
$TLV_c$ = Threshold Limit Value (ceiling)												

**Table 2.5 Toxic Materials – Onsite 2 Co-located Worker** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		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	Consec	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event	)/year	Risk (R, Qualitative	Ranking)	Ris	sk Ma	trix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		<b>I</b> = situation (eve	nt) of major concern				Lik	elihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern		-	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	s	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nba	·	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	111	111	10	1 V
<b>M</b> = 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 > <b>C</b>		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 <sub>c</sub> = 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						

**Table 2.6 Toxic Materials – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead		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	Consec	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event	)/year	Risk (R, Qualitative	Ranking)	Ris	sk Ma	trix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		<b>I</b> = situation (eve	nt) of major concern				Lik	elihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern		-	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	s	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nba	·	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	111	111	10	1 V
<b>M</b> = 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 > <b>C</b>		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 <sub>c</sub> = 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						

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		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 Conse	quence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/yo H = High	I = situation (eve	ent) of major concern	Risk	Matr	ix A	Like U	elihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		<ul> <li>M = Moderate</li> <li>L = Low</li> <li>N = Negligible</li> </ul>	,	vent) of minor concern vent) of minimal concern	nces	Н	I	I	II	III
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	M L	III	III	III IV	IV IV
M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	П	other serious effects, or symptoms which	C ≥ Prompt worker fatality or acute injury that is immediately life- hreatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Co	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 N	Mild, transient adverse effects > C  Consequences less than those for Low	Minor injuries; no hospitalization > C  Consequences less than nose for Low Consequence	Minor injuries; no hospitalization > C  Consequences less than those for Low						
		Consequence Level	Level	Consequence Level						

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	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	equence Matrix", DOE-HD	PBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02 > L > 1.0E-04) EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06 > L)		$\mathbf{M} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	,	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality	Onsite-1 (facility worker)  C ≥ Prompt worker	Conseque	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.  Mild, transient	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	adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 2.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible		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 Conse	quence 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 M = Moderate	t)/year Risk (R, Qualitative Ranking) I = situation (event) of major concern II = situation (event) of concern		Risk	Matri	A	BEU		
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	III = situation (ev	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I II	EU II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	С	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsu	L	III	III	IV	IV
M = Mitigative (reduces event occurrence intermoda)  Acronyms  MOI = Maximally-exposed Offsite Individual	11	other serious effects, or symptoms which	or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M	C ≥ Mild, transient adverse effects.  Mild, transient	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
	N	adverse effects > C  Consequences less	hospitalization > C  Consequences less than	hospitalization > C  Consequences less than						
			hose for Low Consequence Level	those for Low Consequence Level						

Table 2.10 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	l, "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 M = Moderate	t)/year Risk (R, Qualitative Ranking) I = situation (event) of major concern II = situation (event) of concern		Risk Ma		A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	III = situation (e	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsı	L	III	III	IV	IV
M = Mitigative (reduces event occurrence intermoda)  Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
	N	adverse effects > C  Consequences less than those for Low Consequence Level	hospitalization > C  Consequences less than hose for Low Consequence Level	hospitalization > C  Consequences less than those for Low Consequence Level						

 Table 2.11 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-	l, "E	Example Qualitative Cons	equence Matrix", DOE-H	DBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  U = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	<b>I</b> = situation (e	vent) of major concern	Risk	Matri	A A	Like U	lihood EU	BEU
EU = Extremely Unlikely $(1.0E-04 > L > 1.0E-06)$ BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		<ul><li>M - Moderate</li><li>L = Low</li><li>N = Negligible</li></ul>	III = situation	event) of concern (event) of minor concern (event) of minimal concern	ences	H M	I	I	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	C H	C ≥ Irreversible, other serious effects, or symptoms which	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life-	Consequences	L N	III IV	III IV	IV IV	IV IV
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no hospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  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						

**Table 2.12 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, "E	Example Qualitative Cons	equence Matrix", DOE-HE	DBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  U = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU
EU = Extremely Unlikely $(1.0E-04 > L > 1.0E-04)$ BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	,	event) of minor concern event) of minimal concern	ences	H M	I	I	II III	III IV
Control(s) Type 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	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Onsite-1 (facility worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Consequences	L N	III IV	III IV	IV IV	IV IV
	M	action.  C ≥ Mild, transient adverse effects.  Mild, transient	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 N	adverse effects > C  Consequences less	Minor injuries; no hospitalization > C  Consequences less than those for Low Consequence Level	Minor injuries; no hospitalization > C  Consequences less than those for Low Consequence Level						

**Table 2.13 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-	l, "E	Example Qualitative Cons	equence Matrix", DOE-H	DBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  U = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	<b>I</b> = situation (e	vent) of major concern	Risk	Matri	A A	Like U	lihood EU	BEU
EU = Extremely Unlikely $(1.0E-04 > L > 1.0E-06)$ BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		<ul><li>M - Moderate</li><li>L = Low</li><li>N = Negligible</li></ul>	III = situation	event) of concern (event) of minor concern (event) of minimal concern	ences	H M	I	I	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	C H	C ≥ Irreversible, other serious effects, or symptoms which	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life-	Consequences	L N	III IV	III IV	IV IV	IV IV
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no hospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  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						

Table 2.14 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:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equence Matrix", DOE-HD	PBK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I = situation (event) of major concern		Risk	Matri	A	Like U	lihood EU	BEU
U = Unlikely (1.0E-02 > L > 1.0E-04) EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06 > L)		<ul> <li>M = Moderate</li> <li>L = Low</li> <li>N = Negligible</li> </ul>	,	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III IV
Control(s) Type P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality	Onsite-1 (facility worker)  C ≥ Prompt worker	Conseque	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.  Mild, transient	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
	L	adverse effects > C	hospitalization > C	hospitalization > C						
	IN	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 2.15 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	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  A = Anticipated (L > 1.0E-02)  L = Uniting (1.0E-02) L > 1.0E-04)		onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	Risk (R, Qualitative Ranking)  I = situation (event) of major concern  II = situation (event) of concern		Matri	A	Likelihood			
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	III = situation (ev	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III	
Control(s) Type	Н	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsı	L	III	III	IV	IV IV	
		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately lifethreatening or permanently disabling.	Сог	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 2.16 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:
10.01.0015		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  A = Anticipated (L > 1.0E-02)		onsequence (C, of event)/y H = High	I = situation (eve	Risk (R, Qualitative Ranking) I = situation (event) of major concern		Matri	A	Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04) EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06 > L)		<ul> <li>M = Moderate</li> <li>L = Low</li> <li>N = Negligible</li> </ul>	III = situation (e	ation (event) of concern nation (event) of minor concern nation (event) of minimal concern		H M	I	I	II	III IV	
Control(s) Type	Н	Offsite (MOI)	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L	III	III	IV	IV	
		other serious effects, or symptoms which could impair an individual's ability to take protective action.	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.  Mild, transient	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no							
	L N	adverse effects > C	hospitalization > C	hospitalization > C							
	IN	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level							

Table 2.17 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:
1 0 Well tools		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, "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)	Ris	k Matri	ix			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern			Likelihoo			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	səo	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	L	III	III	IV	IV
<ul> <li>P = Preventive (reduce event occurrence likelihood)</li> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>	Н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	Prompt worker fatality acute injury that is immediately life-tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no 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 2.18 Kinetic Energy – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools		L:	See Section I Chapter 04	L:
		C: R:		C: R:
Motion Tables		L:	See Section I Chapter 04	L:
		C: R:		C: 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	ce Matrix", DOE-HD	BK-1163-2020.									
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Ris	k Matr	ix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern									
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ex	vent) of minor concern	s	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sednences	L	III	III	IV	IV			
<ul><li>P = Preventive (reduce event occurrence likelihood)</li><li>M = Mitigative (reduces event consequences)</li></ul>	Н	C ≥ Irreversible, other serious effects,		rompt worker fatality acute injury that is	C ≥ Prompt worker fatality or acute injury that	Con	N	IV	IV	IV	IV			
Acronyms MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	i	mmediately life- ening or permanently disabling.	is immediately life- threatening or permanently disabling.									
	M	C ≥ Mild, transient adverse effects.	imm per	E Serious injury, no sediate loss of life no manent disabilities; bitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.									
	L	Mild, transient adverse effects > C		Minor injuries; no ospitalization > C	Minor injuries; no hospitalization > C									

**Table 2.19 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, "F	Example Qualitative Conse	quence 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 M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	ix Likelihoo A U EU			BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	III
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	С	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsu	L	III	III	IV	IV IV
<ul> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately lifethreatening or permanently disabling.	Сог	N	IV	IV	IV	IV
	М	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 2.20 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	l, "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 M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	A	lihood EU	BEU	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \text{Moderate}$ $\mathbf{L} = \text{Low}$ $\mathbf{N} = \text{Negligible}$	1	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I II	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsı	L	III	III	IV	IV
M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M	C ≥ Mild, transient adverse effects.  Mild, transient	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.						
	N	adverse effects > C  Consequences less	Minor injuries; no hospitalization > C  Consequences less than	Minor injuries; no hospitalization > C  Consequences less than						
			hose for Low Consequence Level	those for Low Consequence Level						

**Table 2.21 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, "F	Example Qualitative Conse	quence 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 M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	ix Likelihoo A U EU			BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	С	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsu	L	III	III	IV	IV
M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	11	other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M	C ≥ Mild, transient adverse effects.  Mild, transient	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.						
	N	adverse effects > C  Consequences less	Minor injuries; no hospitalization > C  Consequences less than	Minor injuries; no hospitalization > C  Consequences less than						
			hose for Low Consequence Level	those for Low Consequence Level						

**Table 2.22 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

Likelihood (L, of event)/year	C	onsequence (C, of event)/y	year Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	* *	I = situation (event) of major concern				lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (eve	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	es	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	***	***	***	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms  MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	immediately life- threatening or permanently disabling.	is immediately life- threatening or permanently disabling.						
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
		-	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 2.23 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)/y	year Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) of major concern				Like	lihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	es	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	<b>IV</b> = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedu		***					
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual		* *	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	S	, , ,								
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	$C \ge Serious injury, no$								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization > C								
	N	Consequences less	Consequences less than	Consequences less than								
		than those for Low	those for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

**Table 2.24 Magnetic Fields – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	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	vear Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				Like	lihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (evolution)	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	<b>III</b> = situation (ev	vent) of minor concern	es	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	***	***	***	***		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual			threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	Z .									
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization > C								
	N	Consequences less	Consequences less than	Consequences less than								
		than those for Low t	those for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

Table 2.25 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L:	See Section I Chapter 04	L:
		C:		C:
AT.		R:		R:
Noise		L:	See Section I Chapter 04	L:
		C:		C: R:
Silica		L:	See Section I Chapter 04	L:
		C:		C:
		R		R:
Ergonomics		L:	See Section I Chapter 04	L:
		C:		C:
		R		R:
Asbestos		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  A = Anticipated (L > 1.0E-02)  U = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	ent) of major concern	Risk	Matri	ix A	Like U	lihood EU	BEU		
EU = Extremely Unlikely $(1.0E-04 > L > 1.0E-04)$ BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	,	event) of minor concern event) of minimal concern	ences	H M	I	I	II III	III IV		
Control(s) Type  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	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Onsite-1 (facility worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Consequences	L N	III IV	III IV	IV IV	IV IV		
	M	action.  C ≥ Mild, transient adverse effects.  Mild, transient	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 N	adverse effects > C  Consequences less	Minor injuries; no hospitalization > C  Consequences less than those for Low Consequence Level	Minor injuries; no hospitalization > C  Consequences less than those for Low Consequence Level								

Table 2.26 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, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  U = Unlikely (1.0E-02> L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (ev	ent) of major concern	Risk	Matri	A A	Like U	lihood EU	BEU		
EU = Extremely Unlikely $(1.0E-04 > L > 1.0E-06)$ BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		<ul><li>M - Moderate</li><li>L = Low</li><li>N = Negligible</li></ul>	,	event) of minor concern event) of minimal concern	ences	H M	I	I	II III	III IV		
Control(s) Type  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	Onsite-2 (co-located worker)  C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	Onsite-1 (facility worker)  C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Consequences	L N	III IV	III IV	IV IV	IV IV		
	M	action.  C ≥ Mild, transient adverse effects.  Mild, transient	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no								
	N	adverse effects > C  Consequences less than those for Low Consequence Level	hospitalization > C  Consequences less than those for Low Consequence Level	hospitalization > C  Consequences less than those for Low Consequence Level								

**Table 2.27 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 Conse	quence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  L = U-1/2-1-(1.0E-02) L > 1.0E-04)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	Tix Likelihood A U EU			BEU
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	С	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsu	L	III	III	IV	IV
		other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 2.28 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 Conse	quence 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 M = Moderate	I = situation (eve	nt) of major concern	Risk	Matri	A	lihood EU	BEU	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I II	II III	III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	С	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	nbəsu	L	III	III	IV	IV
	11	other serious effects, or symptoms which	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life-threatening or permanently disabling.	Cor	N	IV	IV	IV	IV
	M	C ≥ Mild, transient adverse effects.  Mild, transient	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
	N	adverse effects > C  Consequences less	hospitalization > C  Consequences less than	hospitalization > C  Consequences less than						
			hose for Low Consequence Level	those for Low Consequence Level						

Table 2.29 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:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year		onsequence (C, of event)/	year   Risk (R, Qualitative	Risk (R, Qualitative Ranking)		Risk Matrix					
A = 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)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	(event) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	es	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	$IV = situation (e^{-1})$	<b>IV</b> = situation (event) of minimal concern		M	II	II	III	IV	
Control(s) Type		C Offsite (MOI) Onsite-2 (co-located worke		Onsite-1 (facility worker)	sednences	_	TTT	TTT	17.7	17.7	
<b>P</b> = Preventive (reduce event occurrence likelihood)		C ≥ Irreversible,	$C \ge Prompt$ worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV	
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-			•	•	•		
<b>MOI</b> = Maximally-exposed Offsite Individual			threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	C								
		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 > 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 2.30 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  A = Anticipated (L > 1.0E-02)  L = Unlikelik (1.0E-02) L > 1.0E-04)		Consequence (C, of event)/year H = High		Risk (R, Qualitative Ranking)  I = situation (event) of major concern  II = situation (event) of concern  III = situation (event) of minor concern  IV = situation (event) of minimal concern		Risk	Matri	x Likelihood A U EU BEU			
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)	$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		suces			H M	I	I	II III	III IV	
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	C H	Offsite (MOI)		-2 (co-located worker)  Prompt worker fatality	Onsite-1 (facility worker)	-1 (facility worker)  ≥ Prompt worker y or acute injury that immediately life- threatening or		III	III	IV	IV
		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	acute injury that is mmediately life- tening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.			IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects.  Mild, transient	imm per hosp	Eserious injury, no ediate loss of life no manent disabilities; oitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.  Minor injuries; no						
		adverse effects > C  Consequences less than those for Low Consequence Level	Con	ospitalization > C asequences less than for Low Consequence Level	hospitalization > C  Consequences less than those for Low Consequence Level						

**Table 2.31 Environmental** 

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