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: NA*	R: NA*
8.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
8.6	Toxic Materials – MOI Offsite	R: NA*	R: NA*
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: NA*	R: NA*
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: NA*	R: NA*
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: NA*	R: NA*
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: NA*	R: NA*
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: NA*	R: NA*
8.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
8.23	Magnetic Fields – Onsite-2 Co-located Worker	R: NA*	R: NA*
8.24	Magnetic Fields – MOI Offsite	R: NA*	R: NA*
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: NA*	R: NA*
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: NA*	R: NA*
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)
Prompt Ionizing Radiation	Exposure to ionizing radiation from klystrons	L: A C: L R: III	No analysis required	L: A C: L R: III
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. ^{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*	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

Radiological 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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type

- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms

- **MOI =** Maximally-exposed Offsite Individual
- **rem =** Roentgen equivalent man

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** ³ 25.0 rem	**C** ³ 100 rem	**C** ³ 100 rem
M	25.0 rem > **C** ³ 5 rem	100 rem **> C** ³ 25 rem	100 rem **> C** ³ 25 rem
L	5 rem > **C**	25 rem **> C**	25 rem **> C**
N	0.5 rem > **C**	5 rem **> C**	5 rem **> C**

Risk Matrix

Consequences	**Likelihood** A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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)
Prompt Ionizing Radiation	Exposure to ionizing radiation from klystrons	L: A C: L R: III	No analysis required	L: A C: L R: III
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.* *Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.*	L: A C: N R: IV 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. 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: U C: N R: IV 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

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

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year

A = Anticipated (L > 1.0E-02)
U = Unlikely (1.0E-02> L >1.0E-04)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual
rem = Roentgen equivalent man

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** ³ 25.0 rem	**C** ³ 100 rem	**C** ³ 100 rem
M	25.0 rem > **C** ³ 5 rem	100 rem **> C** ³ 25 rem	100 rem **> C** ³ 25 rem
L	5 rem > **C**	25 rem **> C**	25 rem **> C**
N	0.5 rem > **C**	5 rem **> C**	5 rem **> C**

Risk Matrix

Consequences	**Likelihood** A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

Table 8.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	Exposure to ionizing radiation from klystrons	L: N/A C: R:	Hazard does not apply to the public	L: N/A C: R:
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.* *Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.*	L: A C: N R: IV 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. 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: U C: N R: IV 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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Non-ionizing Radiation Hazards	*Hazard: N/A*	L: C: R:		L: C: R:

Radiological 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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual
- **rem =** Roentgen equivalent man

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** ³ 25.0 rem	**C** ³ 100 rem	**C** ³ 100 rem
M	25.0 rem > **C** ³ 5 rem	100 rem **> C** ³ 25 rem	100 rem **> C** ³ 25 rem
L	5 rem > **C**	25 rem **> C**	25 rem **> C**
N	0.5 rem > **C**	5 rem **> C**	5 rem **> C**

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: C: R:
Beryllium		L: C: R:	See Section I Chapter 04	L: C: R:

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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 Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **TLV_c =** Threshold Limit Value (ceiling)

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** ³ PAC-2	**C** ³ PAC-3	**C** ³ IDLH
M	PAC-2 > **C** ³ PAC-1	PAC-3 > **C** ³ PAC-2	IDLH > **C** ³ PEL or TLV_c
L	PAC-1 > **C**	PAC-2 > **C**	PEL or TLV_c > **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 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: C: R:	See Section I Chapter 04	L: C: R:
Beryllium		L: C: R:	See Section I Chapter 04	L: C: R:

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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 Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **TLV_c =** Threshold Limit Value (ceiling)

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** ³ PAC-2	**C** ³ PAC-3	**C** ³ IDLH
M	PAC-2 > **C** ³ PAC-1	PAC-3 > **C** ³ PAC-2	IDLH > **C** ³ PEL or TLV_c
L	PAC-1 > **C**	PAC-2 > **C**	PEL or TLV_c > **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 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: C: R:	See Section I Chapter 04	L: C: R:
Beryllium		L: C: R:	See Section I Chapter 04	L: C: R:

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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 Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **TLV_c =** Threshold Limit Value (ceiling)

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** ³ PAC-2	**C** ³ PAC-3	**C** ³ IDLH
M	PAC-2 > **C** ³ PAC-1	PAC-3 > **C** ³ PAC-2	IDLH > **C** ³ PEL or TLV_c
L	PAC-1 > **C**	PAC-2 > **C**	PEL or TLV_c > **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 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 materials (cables, Boxes, Paper, wood cribbing, etc.)		L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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 materials (cables, Boxes, Paper, wood cribbing, etc.)		L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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 materials (cables, Boxes, Paper, wood cribbing, etc.)		L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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 Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
High Voltage Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
Low Voltage, High Current Exposure.		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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 Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
High Voltage Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
Low Voltage, High Current Exposure.		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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 Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
High Voltage Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
Low Voltage, High Current Exposure.		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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: 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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: 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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: 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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables		L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year

A = Anticipated (L > 1.0E-02)
U = Unlikely (1.0E-02> L >1.0E-04)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables		L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year

A = Anticipated (L > 1.0E-02)
U = Unlikely (1.0E-02> L >1.0E-04)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] 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**

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] 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**

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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		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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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		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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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		L: C: R:		L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.

Likelihood (L, of event)/year
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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, "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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: 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)
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)
BEU = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year

H = High
M = Moderate
L = Low
N = Negligible

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

Control(s) Type

P = Preventive (reduce event occurrence likelihood)
M = Mitigative (reduces event consequences)

Acronyms

MOI = Maximally-exposed Offsite Individual

C	**Offsite (MOI)**	**Onsite-2 (co-located worker)**	**Onsite-1 (facility worker)**
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.
L	Mild, transient adverse effects > **C**	Minor injuries; no hospitalization **> C**	Minor injuries; no hospitalization **> C**
N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level

Risk Matrix

Consequences	Likelihood: A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

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: 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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] 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**

Risk Matrix

Consequences \ Likelihood	A	U	EU	BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

	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 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: 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)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

Consequence (C, of event)/year
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

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

Control(s) Type
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

Acronyms
- **MOI =** Maximally-exposed Offsite Individual

C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)
H	**C** [3] Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	**C** [3] Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.
M	**C** [3] Mild, transient adverse effects.	**C** [3] Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	**C** [3] 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**

Risk Matrix

Consequences	Likelihood A	Likelihood U	Likelihood EU	Likelihood BEU
H	I	I	II	III
M	II	II	III	IV
L	III	III	IV	IV
N	IV	IV	IV	IV

	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 8.31 Environmental

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