Table 2. Summary of Baseline and Residual Risks (Muon Campus)

	Risk Tables Description	Baseline Risk	Residual Risk
2,1	Radiological – Onsite-1 Facility Worker	R: I	R: III, IV
2.2	Radiological – Onsite-2 Co-located Worker	R: I	R: III, IV
2.3	Radiological – MOI Offsite	R: I	R: III, IV
2.4	Toxic Materials – Onsite 1 Facility Worker	R: 1	R: IV
2.5	Toxic Materials – Onsite 2 Co-located Worker	R: 1	R: IV
2.6	Toxic Materials – MOI Offsite	R: 1	R: IV
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: *	R: *
2.23	Magnetic Fields – Onsite-2 Co-located Worker	R: *	R: *
2.24	Magnetic Fields – MOI Offsite	R: *	R: *
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: *

## \* See Section I Chapter 04 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	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	Hazard: Prompt ionizing radiation generated from the particle beam interaction with materials, such as the beam pipes, beamline elements, and beamline instrumentation, and direct beam exposure.	L: A C: H R: I	<ul> <li>P – Shielding in place around the beam line enclosures per the relevant shielding assessments</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> <li>P – Search and secure of beam enclosure by main control room prior to beam delivery</li> <li>M – Dosimetry as required by the relevant RWP</li> <li>M – Audible alarm when enclosure is interlocked before beam is delivered</li> </ul>	L: BEU C: N R: IV
Residual activation	Hazard: Accelerator components can become activated from beam loss. Exposure to these activated components is possible.	L: A C: H R: I	P – Enclosure keys linked to radiological and controlled access training to enter enclosure  M – Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately  M – Any item requiring shipment or unrestricted release is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.  M – Dosimetry as required by the relevant RWP  M – Enclosure surveys as required by the relevant RWP  M – PPE as required by the relevant RWP	L: U C: N R: IV
Groundwater Activation	Hazard: Scattered beam has potential to activate ground water at low levels calculated in the shield assessment.	L: A C: N R: IV	M – Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.	L: A C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazard: 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 Water (RAW) Systems	Hazard: RAW water system is used to cool the Lithium Lens, Pulsed Magnet and the beam absorber in the AP0 target hall.	L: A C: M R: II	P – Locked cage containing water equipment is controlled by the RSO who only grants access once radiation rates have dropped to safe levels.  P – Radiation training required to access the water cage.  M – Radiation Technician coverage required for water cage access  M – Dosimetry as required by the relevant RWP	L: EU C: N R: IV
Air Activation	Hazard: The 8 GeV protons interacting with the target and immediate air volume can radioactivate the air which could then migrate to accessible areas.	L: A C: H R: I	<ul> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure and service building keys linked to radiological and controlled access training to enter enclosure</li> <li>P – Activated air monitor is installed in the service building.</li> <li>M – Air flow controlled to route air through HEPA filter and decay path to allow activation to decay before being released.</li> </ul>	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Soil Interactions	Hazard: Scattered beam has potential	L: A	M - Sensing equipment (chipmunks) to shut off beam if it exceeds the	L: A
	to activate soil at low levels calculated	C: N	operating parameters (defense in depth) determined by the shield	C: N
	in the shield assessment.	R: IV	assessment.	R: IV
Radioactive	Hazard: Persons are exposed to	L: A	P – Radiological worker training	L: BEU
waste	ionizing radiation beyond regulatory	C: H	P – Any item in a beam enclosure during beam-on conditions is removed	C: H
	levels	R: I	and surveyed by radiological workers and classified appropriately (typically class 0 at these facilities).  P – Any item identified for disposal is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	R: III
Contamination	Hazard: Activated dust or debris	L: A	P – Radiation surveys of areas before work.	L: BEU
	could be ingested by worker or	C: H	P – Contamination wipes taken regularly in areas of likely contamination.	C: L
	removed from radiation area unintentionally.	R: I	P – RWP specifies PPE P – training – frisking upon exit	R: III
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: A	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't	L: A
	to 7Be (uptake/committed dose).	C: N	hazardous in this pattern of use by facility.	C: N
		R: IV		R: IV
Non-ionizing		L:	See Section I Chapter 04	L:
Radiation		C:		C:
Hazards		R:		R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	Ranking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	t) of major concern	ļ		Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{H} = \text{situation (even}$	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<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)	edn		***	***		
<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	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	Hazard: Prompt ionizing radiation generated from the particle beam interaction with materials, such as the beam pipes, beamline elements, and beamline instrumentation, and direct beam exposure.	L: A C: H R: I	<ul> <li>P – Shielding in place around the beam line and experiment enclosures per the relevant shield assessments</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> <li>M – Dosimetry as required by the relevant RWP</li> <li>M – Enclosure surveys as required by the relevant RWP</li> <li>M – PPE as required by the relevant RWP</li> </ul>	L: BEU C: N R: IV
Residual Activation	Hazard: Accelerator components can become activated from beam loss. Exposure to these activated components is possible.	L: A C: N R: IV	P – Enclosure keys linked to radiological and controlled access training to enter enclosure  M – Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately  M – Any item requiring shipment or unrestricted release is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.  M – Dosimetry as required by the relevant RWP  M – Enclosure surveys as required by the relevant RWP  M – PPE as required by the relevant RWP	L: U C: N R: IV
Groundwater Activation	Hazard: Scattered beam has potential to activate ground water at low levels calculated in the shield assessment.	L: A C: N R: IV	M – Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.	L: A C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazard: 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 Water (RAW) Systems	Hazard: RAW water system is used to cool the Lithium Lens, Pulsed Magnet and the beam absorber in the APO target hall.	L: A C: M R: II	<ul> <li>P – Locked cage containing water equipment is controlled by the RSO who only grants access once radiation rates have dropped to safe levels.</li> <li>P – Radiation training required to access the water cage.</li> <li>M – Radiation Technician coverage required for water cage access</li> </ul>	L: EU C: N R: IV
Air Activation	Hazard: The 8 GeV protons interacting with the target and immediate air volume can radioactivate the air which could then migrate to accessible areas.	L: A C: H R: I	<ul> <li>M – Dosimetry as required by the relevant RWP</li> <li>M – PPE as required by the relevant RWP</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure and service building keys linked to radiological and controlled access training to enter enclosure</li> <li>P – Activated air monitor is installed in the service building.</li> <li>M – Air flow controlled to route air through HEPA filter and decay path to allow activation to decay before being released.</li> </ul>	L: EU C: M R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Soil Interactions	Hazard: Scattered beam has potential to activate soil at low levels calculated in the shield assessment.	L: A C: N R: IV	M – Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.	L: A C: N R: IV
Radioactive waste	Hazard: Persons are exposed to ionizing radiation beyond regulatory levels	L: A C: H R: I	P – Radiological worker training P – Any item in a beam enclosure during beam-on conditions that is removed is surveyed by radiological workers and classified appropriately. P – Any item identified for disposal is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	L: BEU C: H R: III
Contamination	Hazard: Activated dust or debris could be ingested by worker or removed from radiation area unintentionally.	L: A C: H R: I	P – Radiation surveys of areas before work. P – Contamination wipes taken regularly in areas of likely contamination. P – RWP specifies PPE P – training – frisking upon exit	L: BEU C: H R: III
<sup>7</sup> Be	Hazard: Potential radiation exposure to 7Be (uptake/committed dose).	L: A C: N R: IV	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this pattern of use by facility.	L: A C: N R: IV
Non-ionizing Radiation Hazards		L: C: R:	See Section I Chapter 04	L: C: R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	Ranking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	t) of major concern	ļ		Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{H} = \text{situation (even}$	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<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)	edn		***	***		
<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 2.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing	Hazard: Prompt ionizing radiation	L: A	P – Public screening at Fermi site boundary	L: BEU
Radiation	generated from the particle beam	C: H	P – Facility is locked preventing unescorted access	C: L
	interaction with materials, such as the beam pipes, beamline elements, and beamline instrumentation, and direct beam exposure.	R: I	<ul> <li>P – Shielding in place around the beam line and experiment enclosures per the relevant shield assessments</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> <li>M – Escort training to recognize hazards</li> <li>M – Safety briefing before tour</li> </ul>	R: IV
Residual	Hazard: Accelerator components can	L: A	P – Public screening at Fermi site boundary	L: BEU
Activation	become activated from beam loss.	C: N	P – Facility is locked preventing unescorted access	C: N
	Exposure to these activated components is possible.	R: IV	<ul> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> <li>M – Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately</li> <li>M – Any item requiring shipment or unrestricted release is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.</li> <li>M – Dosimetry as required by the relevant RWP</li> <li>M – Enclosure surveys as required by the relevant RWP</li> <li>M – PPE as required by the relevant RWP</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Groundwater Activation	Hazard: Scattered beam has potential to activate ground water at low levels	L: A C: N	P – Public screening at Fermi site boundary P – Facility is locked preventing unescorted access	L: EU C: N
	calculated in the shield assessment.	R: IV	M – Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.	R: IV
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	Hazard: RAW water system is used to	L: A	P – Public screening at Fermi site boundary	L:BEU
Water (RAW)	cool the Lithium Lens, Pulsed Magnet	C: M	P – Facility is locked preventing unescorted access	C: N
Systems	and the beam absorber in the AP0 target hall.	R: II	<ul> <li>P – Locked cage containing water equipment is controlled by the RSO who only grants access once radiation rates have dropped to safe levels.</li> <li>P – Radiation training required to access the water cage.</li> <li>M – Radiation Technician coverage required for water cage access</li> <li>M – Dosimetry as required by the relevant RWP</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Air Activation	Hazard: The 8 GeV protons interacting with the target and immediate air volume can radioactivate the air which could then migrate to accessible areas.	L: A C: H R: I	<ul> <li>P – Public screening at Fermi site boundary</li> <li>P – Facility is locked preventing unescorted access</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Cool off time imposed at discretion of RSO after beam operations</li> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> <li>M – The existing ventilation system in Pre-Target/Pre-Vault enclosures slows transit time adequately to allow for radioactive decay of short-lived positron emitters</li> <li>M - Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.</li> </ul>	L: BEU C: L R: IV
Soil Interactions	Hazard: Scattered beam has potential to activate soil at low levels calculated in the shield assessment.	L: A C: N R: IV	P – Public screening at Fermi site boundary M - Sensing equipment (chipmunks) to shut off beam if it exceeds the operating parameters (defense in depth) determined by the shield assessment.	L: U C: N R: IV
Radioactive waste	Hazard: persons are exposed to ionizing radiation beyond regulatory levels	L: A C: H R: I	P – Public screening at Fermi site boundary P – Facility is locked preventing unescorted access P – Any item identified for disposal is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	L: BEU C: H R: III
Contamination	Hazard: Activated dust or debris could be encountered if it were unintentionally removed from radiation area.	L: A C: H R: I	P – Radiation surveys of areas before work. P – Contamination wipes taken regularly in areas of likely contamination. P – RWP specifies PPE P – training – frisking upon exit	L: BEU C: H R: III

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
<sup>7</sup> Be	Hazard: Potential radiation exposure to 7Be (uptake/committed dose).	L: BEU C: N R: IV	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this pattern of use by facility.	L: BEU C: N R: IV
Non-ionizing Radiation Hazards	Hazard: Laser tracker equipment used by metrology personnel could cause eye injuries.	L: EU C: N R: IV	P – Metrology group is trained in safe use of laser tracker equipment.	L: BEU C: N R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	lanking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		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	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn					
<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 > <b>C</b>		25 rem > C	25 rem > <b>C</b>						
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)
Fluorinert & Its	Hazard: Potential exposure to	L: A	Not Applicable	L: A
byproducts	Fluorinert	C: N		C: N
		R: IV		R: IV
	Potential exposure to Fluorinert decomposition products (HF, PFIB).	L: A C: H	P – Fluorinert and decomposition products are contained in a closed system.	L: EU C: L
		R: I	<ul> <li>P – Maintenance Program identifies and implements appropriate controls to prevent exposure if system is to be breached.</li> <li>M – Fluorinert handling procedures exist for workers dealing with devices containing Fluorinert.</li> <li>M – Enclosure circulation and ventilation fans would disperse any released Fluorinert byproducts.</li> </ul>	R: IV

Chemical Hazard Consequences, derived from Figure	C-1,	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event	)/year	Risk (R, Qualitative	Ranking)	Risk 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		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	səs	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ex	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т	TTT	тт	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ous	L	III	III	1 V	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  IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > <b>C</b>		PAC-2 > C	PEL or $TLV_c > C$						_
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 2.5 Toxic Materials – Onsite 2 Co-located Worker** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fluorinert & Its	Hazard: Potential exposure to	L: U	Evaluated as non-hazardous through pattern of use.	L: U
byproducts	Fluorinert	C: N		C: N
		R: IV		R: IV
	Potential exposure to Fluorinert	L: U	P – Fluorinert and decomposition products are contained in a closed	L: BEU
	decomposition products (HF, PFIB).	C: H	system.	C: L
		R: I	<ul> <li>P – Maintenance Program identifies and implements appropriate controls to prevent exposure if system is to be breached.</li> <li>M – Filtration installed to remove hazardous byproducts reduces</li> </ul>	R: IV
			consequences of exposure.	
			M – Fluorinert handling procedures exist for workers dealing with devices containing Fluorinert.	

Chemical Hazard Consequences, derived from Figure	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.							
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern	l	1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	es	Н	I	I	II	III	
<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)	edn	т т	Ш	Ш	IV	IV	
	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Suo	L	111	111	1 V	1 V	
<b>M</b> = Mitigative (reduces event consequences)	М	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV	
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$							
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV <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)
Fluorinert & Its	Hazard: Potential exposure to	L: EU	Evaluated as non-hazardous through pattern of use.	L: EU
byproducts	Fluorinert	C: N		C: N
		R: IV		R: IV
	Potential exposure to Fluorinert	L: EU	P – Access to systems containing Fluorinert is prevented.	L: BEU
	decomposition products (HF, PFIB).	C: H	P – Fluorinert and decomposition products are contained in a closed	C: M
		R: II	system.	R: IV
			M – Filtration installed to remove hazardous byproducts reduces	
			consequences of exposure.	

Chemical Hazard Consequences, derived from Figure	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.							
Likelihood (L, of event)/year	C	onsequence (C, of event	)/year	Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern		1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	ses	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ex	vent) of minimal concern	ences	M	П	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn		TTT	111	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	III	III	1 V	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  IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$							
MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV <sub>c</sub> = Threshold Limit Value (ceiling)	Ν	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		C:		C:
(cables, Boxes,		R:		R:
Paper, 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)  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	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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	EU 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 occurrence intermood)</li> <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.	ŭ	O N		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 2.8 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		C:		C:
(cables, Boxes,		R:		R:
Paper, 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	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	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)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	1	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	BEU III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)	C H	Offsite (MOI)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	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 2.9 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		C:		C:
(cables, Boxes,		R:		R:
Paper, 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	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	Likelihood				
EU = Extremely Unlikely $(1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ BEU = Beyond Extremely Unlikely $(1.0\text{E}-06 > \text{L})$		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I	I	II III	BEU III IV		
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	C ≥ Irreversible,	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequences	L	III	III	IV IV	IV IV		
Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		1						
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.								
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C								
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level								

**Table 2.10 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:
1		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
1		R:		R:

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year I	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	nt) of major concern				Like		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	ses	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	_	TTT	777	77.7	17.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	mpt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-					•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	$C \ge S$	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immed	liate loss of life no	immediate loss of life no						
			perma	anent disabilities;	permanent disabilities;						
			hospit	alization required.	hospitalization required.						
	L	Mild, transient	Min	nor injuries; no	Minor injuries; no						
		adverse effects > C	hos	pitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those for	r Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

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

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year I	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (even	nt) of major concern				Like		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	ses	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	_	TTT	777	77.7	17.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	mpt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-					•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	$C \ge S$	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immed	liate loss of life no	immediate loss of life no						
			perma	anent disabilities;	permanent disabilities;						
			hospit	alization required.	hospitalization required.						
	L	Mild, transient	Min	nor injuries; no	Minor injuries; no						
		adverse effects > C	hos	pitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those for	r Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 2.12 Electrical Energy – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	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:

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year I	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	ses	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	_	TTT	777	77.7	17.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	mpt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-					•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	$C \ge S$	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immed	liate loss of life no	immediate loss of life no						
			perma	anent disabilities;	permanent disabilities;						
			hospit	alization required.	hospitalization required.						
	L	Mild, transient	Min	nor injuries; no	Minor injuries; no						
		adverse effects > C	hos	pitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those for	r Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 2.13 Thermal Energy – Onsite-1 Facility Worker** 

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

Other Hazard Consequences, derived from Figure C-1	l, "F	Example Qualitative Cons	sequence Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (evolution (evolution)}$	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ev	vent) of minor concern	seou	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)	nbə	_		***				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suc	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	Coi	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	disasing.	permanently disasting.								
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization > C								
	N	Consequences less	Consequences less than	Consequences less than								
		than those for Low	those for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work		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	Co	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	nt) of major concern									
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	ent) of concern	l .	ı	A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (ev	vent) of minor concern	S	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	edno	_	***	***	***	***			
<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	5										
		action.											
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no	1								
		adverse effects.	immediate loss of life no	immediate loss of life no									
			permanent disabilities;	permanent disabilities;									
			hospitalization required.	hospitalization required.									
	L	Mild, transient	Minor injuries; no	Minor injuries; no	1								
		adverse effects $> \mathbf{C}$	hospitalization > C	hospitalization > C									
	N	Consequences less	Consequences less than	Consequences less than									
		than those for Low	those for Low Consequence	those for Low									
		Consequence Level	Level	Consequence Level									

Table 2.15 Thermal Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (evolution (evolution)}$	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ev	vent) of minor concern	seou	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)	nba	_				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Suc	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	Coi	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	disability.	permanently disabiling.						
		action.								
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects > C	hospitalization > C	hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 2.16 Kinetic Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High M = Moderate	I = situation (eve	Risk (R, Qualitative Ranking) I = situation (event) of major concern			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)		$\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$	-	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)  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 IV	
		other serious effects, or symptoms which	or acute injury that is immediately life- hreatening 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.							
7		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 2.17 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:
Pumps and Motors		L: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Ris	k Matı	rix	K				
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		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	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	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sednences	L	III	III	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	Н	C ≥ Irreversible, other serious effects,		Prompt worker fatality acute injury that is	$C \ge Prompt worker$ fatality or acute injury that	Con	N	IV		IV	IV		
Acronyms  MOI = Maximally-exposed Offsite Individual		or symptoms which	i	immediately life- tening or permanently disabling.	is immediately life- threatening or permanently disabling.								
		C ≥ Mild, transient adverse effects.	imm per	≥ Serious injury, no nediate loss of life no rmanent disabilities; pitalization 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 2.18 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:
rowel tools		C:		C:
		R:		R:
Pumps and		L:	See Section I Chapter 04	L:
Motors		C:		C:
		R:		R:
Motion Tables		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative Ranking)			Matri	X	ς				
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)		M = Moderate		II = situation (ev	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	se	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)	sedneuces	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 hos <u>p</u>	≥ 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 2.19 Potential Energy – Onsite-1 Facility Worker** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane		L:	See Section I Chapter 04	L:
Operations		C:		C:
		R:		R:
Compressed		L:	See Section I Chapter 04	L:
Gasses		C:		C:
		R:		R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure Vessels		C:		C:
		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Material		L:	See Section I Chapter 04	L:
Handling		C:		C:
		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	I = situation (eve	nt) of major concern	Risk	Matri		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>	,	ent) of concern vent) of minor concern vent) of minimal concern	ences	Н	I II	I	II	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)	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) $C \ge \text{Prompt worker}$	Conseque	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.		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	hospitalization > C  Consequences less than hose for Low Consequence Level	hospitalization > C  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		L:	See Section I Chapter 04	L:
Operations		C:		C:
1		R:		R:
Compressed		L:	See Section I Chapter 04	L:
Gasses		C:		C:
		R:		R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure Vessels		C:		C:
		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Material		L:	See Section I Chapter 04	L:
Handling		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	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)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	BEU 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.  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 2.21 Potential Energy – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane		L:	See Section I Chapter 04	L:
Operations		C:		C:
•		R:		R:
Compressed		L:	See Section I Chapter 04	L:
Gasses		C:		C:
		R:		R:
Vacuum/		L:	See Section I Chapter 04	L:
Pressure Vessels		C:		C:
		R:		R:
Vacuum Pumps		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Material		L:	See Section I Chapter 04	L:
Handling		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	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)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	BEU 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.  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 2.22 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:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (evolution (evolution)}$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (evolution)	vent) of minor concern	seou	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)	nbə	_		***			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suc	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	Coi	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	disasing.	permanently disasting.							
		action.									
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects > C	hospitalization > C	hospitalization > C							
	N	Consequences less	Consequences less than	Consequences less than							
		than those for Low	those for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

Table 2.23 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:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year Risk (R, Qualitative	Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	vent) of concern	l		A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	<b>III</b> = situation (e	event) of minor concern	es	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	$IV = situation (e^{-1})$	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	***	***	77.7	***		
<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		could impair an	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	2									
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization $> C$	hospitalization > C								
	N	Consequences less	Consequences less than	Consequences less than								
		than those for Low	those for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

**Table 2.24 Magnetic Fields – MOI Offsite** 

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	year Risk (R, Qualitative	Ranking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) of major concern				lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	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	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	YYY	***	***	***
<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-						
MOI = 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 ≥ 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 2.25 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined		L:	See Section I Chapter 04	L:
Spaces		C: R:		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:
Working at		L:	See Section I Chapter 04	L:
heights		C: R:		C: R:
Lithium	Hazard: Lithium is used in the focusing lens in the AP0 target station. Lithium itself is reactive and flammable. Contact with moisture produces lithium hydroxide which is caustic.	L: A C: H R: I	<ul> <li>P – The lithium in the lens is completely encased and there are conductivity interlocks that are an early indicator of a containment breach.</li> <li>P – Spare lithium is kept in an oil container to avoid contact with air or moisture.</li> <li>P – The container for spare lithium is kept in a flammable material cabinet in the AP0 service building.</li> <li>M – A fire extinguisher suitable for lithium is maintained in AP0</li> <li>M – The Fermilab fire department is trained on the lithium hazard at AP0 and the response to an incident.</li> </ul>	L: BEU C: L R: IV

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year  A = Anticipated (L > 1.0E-02)  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	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)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$		vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	BEU
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	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.  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						
		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 2.26 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		L:	See Section I Chapter 04	L:
Spaces		C: R:		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:
Working at		L:	See Section I Chapter 04	L:
heights		C: R:		C: R:
Lithium	Hazard: Lithium is used in the focusing lens in the AP0 target station. Lithium itself is reactive and flammable. Contact with moisture produces lithium hydroxide which is caustic.	L: A C: H R: I	<ul> <li>P – The lithium in the lens is completely encased and there are conductivity interlocks that are an early indicator of a containment breach.</li> <li>P – Spare lithium is kept in an oil container to avoid contact with air or moisture.</li> <li>P – The container for spare lithium is kept in a flammable material cabinet in the AP0 service building.</li> <li>M – A fire extinguisher suitable for lithium is maintained in AP0</li> <li>M – The Fermilab fire department is trained on the lithium hazard at AP0 and the response to an incident.</li> </ul>	L: BEU C: L R: IV

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	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	I = situation (eve	ent) of major concern	Risk	Matri	ix 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>	,	vent) of minor concern vent) of minimal concern	ences	H M	I	I	II	BEU III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	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
		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 2.27 Other hazards – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined		L:	See Section I Chapter 04	L:
Spaces		C:		C:
		R:		R:
Noise		L:	See Section I Chapter 04	L:
		C:		C:
		R:		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:
Working at		L:	See Section I Chapter 04	L:
heights		C:		C:
_		R:		R:
Lithium	Hazard: Lithium is used in the	L: A	P – Lithium is confined to the AP0 target service building which is away	L: BEU
	focusing lens in the AP0 target	C: H	from any publicly accessible area.	C: L
	station. Lithium itself is reactive and	R: I	P – The lithium in the lens is completely encased and there are conductivity	R: IV
	flammable. Contact with moisture		interlocks that are an early indicator of a containment breach.	
	produces lithium hydroxide which is caustic.		P – Spare lithium is kept in an oil container to avoid contact with air or moisture.	
			P – The container for spare lithium is kept in a flammable material cabinet	
			in the AP0 service building.	
			M – A fire extinguisher suitable for lithium is maintained in AP0	
			M – The Fermilab fire department is trained on the lithium hazard at AP0	
			and the response to an incident.	

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	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)		$\mathbf{L} = \mathbf{M}$ $\mathbf{L} = \mathbf{L}$ $\mathbf{N} = \mathbf{N}$ $\mathbf{N} = \mathbf{N}$	-	vent) of concern vent) of minor concern vent) of minimal concern	ences	H M	I II	I	II III	BEU 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.  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							
		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 2.28 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		L:	See Section I Chapter 04	L:
Egress		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (evolution (evolution)}$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (evolution)	vent) of minor concern	seou	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)	nbə	_		***			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suc	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	Coi	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	disasing.	permanently disasting.							
		action.									
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects > C	hospitalization > C	hospitalization > C							
	N	Consequences less	Consequences less than	Consequences less than							
		than those for Low	those for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

Table 2.29 Access & Egress – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event).	year Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	ent) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	S	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern	ences	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***	***	***	***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	13	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	Co	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	S								
		action.									
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects > C	hospitalization $> C$	hospitalization > C							
	N	Consequences less	Consequences less than	Consequences less than							
		than those for Low	those for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

**Table 2.30 Access & Egress – MOI Offsite** 

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event).	year Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				lihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation (ev	ent) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	S	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern	ences	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***	***	***	***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	13	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	Co	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	S								
		action.									
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	immediate loss of life no	immediate loss of life no							
			permanent disabilities;	permanent disabilities;							
			hospitalization required.	hospitalization required.							
	L	Mild, transient	Minor injuries; no	Minor injuries; no							
		adverse effects > C	hospitalization $> C$	hospitalization > C							
	N	Consequences less	Consequences less than	Consequences less than							
		than those for Low	those for Low Consequence	those for Low							
		Consequence Level	Level	Consequence Level							

**Table 2.31 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: