

**Table 2. Summary of Baseline and Residual Risks (IOTA/FAST Electron Injector)**

Risk Tables Description		Baseline Risk	Residual Risk
2.1	Radiological – Onsite-1 Facility Worker	R: I	R: IV
2.2	Radiological – Onsite-2 Co-located Worker	R: I	R: IV
2.3	Radiological – MOI Offsite	R: N/A	R: N/A
2.4	Toxic Materials – Onsite 1 Facility Worker	R: I	R: IV
2.5	Toxic Materials – Onsite 2 Co-located Worker	R: I	R: IV
2.6	Toxic Materials – MOI Offsite	R: I	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: *

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

**NOTE:**

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

“Events with an unmitigated risk value of III or IV would not require additional control assignments to provide reasonable assurance of adequate protection. Whereas, for events with an unmitigated risk value of I or II, controls would need to be assigned to either reduce the likelihood or the consequence, and therefore the overall mitigated risk. Generally, preventive controls are applied prior to a loss event – reflecting a likelihood reduction and mitigative controls are applied after a loss event – reflecting a consequence reduction. Each control is credited for a single “bin drop” either in likelihood or consequence; not both. Following a standard hierarchy of controls, controls are applied until the residual risk is acceptable – reflecting a mitigated risk value of III or IV. After controls are credited, events with a remaining unacceptable residual risk (i.e., I or II) are candidates for additional

analyses and additional controls, often quantitative in nature.” For Fermilab, these controls for accelerator-specific hazards are identified as Credited Controls and further summarized in the Accelerator Safety Envelope (ASE).



**Table 2.1 Radiological – Onsite-1 Facility Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt Ionizing Radiation	<p><i>Hazard: Prompt ionizing radiation levels inside and surrounding the enclosures that are present during operation. The radiation may include neutrons and other energetic particles.</i></p>	<p>L: A C: H R: I</p>	<p>P: Shielding in place around the beam line and experiment enclosures per the relevant shield assessments P: Interlock system preventing access to beam enclosure while beam is present. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: Search and secure of beam enclosure by main control room prior to beam delivery M: Dosimetry as required by the relevant RWP M: Audible alarm when enclosure is interlocked before beam is delivered</p>	<p>L: BEU C: N R: IV</p>
Residual activation	<p><i>Hazard: Electron absorber surfaces and the associated vacuum windows immediately upstream along with beamline components may be radioactive even when the electron beamline is not in operation.</i></p>	<p>L: A C: N R: IV</p>	<p>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</p>	<p>L: U C: N R: IV</p>

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Groundwater Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. M: Groundwater is sampled regularly as part of the ES&H Environmental Monitoring Program and in accordance with the Fermilab Environment, Safety, and Health Manual (FESHM) chapter, <i>Surface Water Protection</i> .	L: EU C: N R: IV
Surface Water Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. P: Groundwater is sampled regularly as part of the ES&H Environmental Monitoring Program and in accordance with the Fermilab Environment, Safety, and Health Manual (FESHM) chapter, <i>Surface Water Protection</i> .	L: EU C: N R: IV
Radioactive Water (RAW) Systems	<i>Hazard: RAW systems present at both High and Low energy electron absorbers.</i>	L: A C: N R: IV	P: Interlock system preventing access to beam enclosure while beam is present. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: Integrated RAW leak containment systems. 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: BEU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Air Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. M: Ventilation system to prevent accumulation of radioactive gaseous isotopes.	L: EU C: N R: IV
Soil Interactions	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: BEU C: N R: IV	P: Shielding in place around the beam line and experiment enclosures per the relevant shield assessments	L: BEU C: N R: IV
Radioactive waste	<i>Hazard: Although production of radioactive material is not an operational function of the IOTA/FAST Facility beamlines, beam loss or intentional interception of the beam in some diagnostic devices may result in activation of these components or other beam line elements.</i>	L: A C: N R: IV	M: Radiological worker training M: Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately (typically class 0 at these facilities). M: Any item identified for disposal is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	L: A C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Radioactive Sources	<i>Hazard: Various low activity sealed sources (Sr-90, Co-60, CS-137, Fe-55, Ru-106, etc.)</i>	L: A C: N R: IV	P: All low activity sealed sources are kept in a lock box and registered through Radiological Control. M: Radiological training is required for source handling.	L: U C: N R: IV
Radiation Generating Devices (RDGs)	<i>Hazard: 50 kV proton source has the potential to create X-ray radiation.</i>	L: U C: H R: I	P: Designed to be self-shielded. M: Radiological worker training M: Self-shielding verification protocol performed by RSO/RCT	L: EU C: L R: IV

<p>Non-ionizing Radiation Hazards</p>	<p><i>Hazard: Hazardous levels of radio frequency electromagnetic energy are generated by the RF power sources (Klystrons) for the IOTA/FAST Facility Electron Injector.</i></p> <p><i>Hazard: Radiofrequency accelerating structures, including those used in the IOTA/FAST Facility, may generate electromagnetic fields of sufficient amplitude to generate 'dark-current' electrons of sufficient energy to produce x-rays.</i></p> <p><i>Hazard: Class 3B and Class 4, near-infrared, UV, and visible lasers will be used in the IOTA/FAST Facility for purposes such as electron production, beam diagnostics, beam instrumentation, and dedicated studies.</i></p>	<p>L: A C: H R: I</p> <p>L: A C: M R: I</p> <p>L: A C: H R: I</p>	<p>P: Painted Lead shielding specifically designed for each klystron. P: Antennae have been installed in the controls racks for each RF system to monitor leakage and automatically shut off the appropriate RF system. M - Specific "Lock-out/Tag-out" (LOTO) and configuration control procedures are in place to establish safe conditions for personnel working on or around these systems. M: Periodic surveys for stray RF fields are also performed by Fermilab ES&amp;H Section.</p> <p>P: Concrete shielding blocks to reduce dose rates below 1.0mrem/hour at all energies. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: The safety interlock system for the IOTA/FAST Facility ADRDA enclosure disables RF power to the cavities thereby mitigating the x-ray hazard whenever personnel access the enclosure. M: Radiological worker training</p> <p>P: Subject Matter Expert (SME) reviews laser installation P: Production and delivery of these lasers both outside and inside the beamline enclosure are required to be completely contained to transport pipes or designated enclosures for the Class 3B and Class 4 lasers P: Keyed interlock system controlling laser operation as dictated by laser classification M: Establishing the Laser Contained Area (LCA) limits surrounding areas to remaining below the Maximum Permissible Exposure (MPE) as set by the Laser Safety Officer (LSO). M: Experimenters take eye exams and sign SOP as determined by the SME.</p>	<p>L: EU C: L R: IV</p> <p>L: BEU C: L R: IV</p> <p>L: BEU C: N R: IV</p>
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Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
			M: Special training for experimenters M: PPE as determined by SOP	

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Acronyms</b> MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	<b>H</b>	$C \geq 25.0 \text{ rem}$	$C \geq 100 \text{ rem}$	$C \geq 100 \text{ rem}$																																
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**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	<i>Hazard: Prompt ionizing radiation levels inside and surrounding the enclosures that are present during operation. The radiation may include neutrons and other energetic particles.</i>	L: A C: H R: I	P: Shielding in place around the beam line and experiment enclosures per the relevant shield assessments P: Interlock system preventing access to beam enclosure while beam is present. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: Search and secure of beam enclosure by main control room prior to beam delivery M: Dosimetry as required by the relevant RWP M: Audible alarm when enclosure is interlocked before beam is delivered	L: BEU C: N R: IV
Residual activation	<i>Hazard: Electron absorber surfaces and the associated vacuum windows immediately upstream along with beamline components may be radioactive even when the electron beamline is not in operation.</i>	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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Groundwater Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. M: Groundwater is sampled regularly as part of the ES&H Environmental Monitoring Program and in accordance with the Fermilab Environment, Safety, and Health Manual (FESHM) chapter, <i>Surface Water Protection</i> .	L: EU C: N R: IV
Surface Water Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. M: Groundwater is sampled regularly as part of the ES&H Environmental Monitoring Program and in accordance with the Fermilab Environment, Safety, and Health Manual (FESHM) chapter, <i>Surface Water Protection</i> .	L: EU C: N R: IV
Radioactive Water (RAW) Systems	<i>Hazard: RAW systems present at both High and Low energy electron absorbers.</i>	L: A C: N R: IV	P: Interlock system preventing access to beam enclosure while beam is present. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: Integrated RAW leak containment systems. 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: BEU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Air Activation	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: EU 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. M: Ventilation system to prevent accumulation of radioactive gaseous isotopes.	L: EU C: N R: IV
Soil Interactions	<i>Hazard: Radioactivity is induced by photo-nuclear interaction with the soils that surround the accelerator enclosure.</i>	L: BEU C: N R: IV	P: Shielding in place around the beam line and experiment enclosures per the relevant shield assessments	L: BEU C: N R: IV
Radioactive waste	<i>Hazard: Although production of radioactive material is not an operational function of the IOTA/FAST Facility beamlines, beam loss or intentional interception of the beam in some diagnostic devices may result in activation of these components or other beam line elements.</i>	L: A C: N R: IV	M: Radiological worker training M: Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately (typically class 0 at these facilities). M: Any item identified for disposal is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	L: A C: N R: IV

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<p>Non-ionizing Radiation Hazards</p>	<p><i>Hazard:</i>  <i>Hazardous levels of radio frequency electromagnetic energy are generated by the RF power sources (Klystrons) for the IOTA/FAST Facility Electron Injector.</i></p> <p><i>Hazard:</i>  <i>Radiofrequency accelerating structures, including those used in the IOTA/FAST Facility, may generate electromagnetic fields of sufficient amplitude to generate 'dark-current' electrons of sufficient energy to produce x-rays.</i></p> <p><i>Hazard:</i>  <i>Class 3B and Class 4, near-infrared, UV, and visible lasers will be used in the IOTA/FAST Facility for purposes such as electron production, beam diagnostics, beam instrumentation, and dedicated studies.</i></p>	<p>L: A  C: H  R: I</p> <p>L: A  C: M  R: I</p> <p>L: A  C: H  R: I</p>	<p><b>P:</b> Painted Lead shielding specifically designed for each klystron.  <b>P:</b> Antennae have been installed in the controls racks for each RF system to monitor leakage and automatically shut off the appropriate RF system.  M - Specific "Lock-out/Tag-out" (LOTO) and configuration control procedures are in place to establish safe conditions for personnel working on or around these systems.  M - Periodic surveys for stray RF fields are also performed by Fermilab ES&amp;H Section.</p> <p>P: Concrete shielding blocks to reduce dose rates below 1.0mrem/hour at all energies.  P: Enclosure keys linked to radiological and controlled access training to enter enclosure  P: The safety interlock system for the IOTA/FAST Facility ADRDA enclosure disables RF power to the cavities thereby mitigating the x-ray hazard whenever personnel access the enclosure.  M: Radiological worker training</p> <p>P: Subject Matter Expert (SME) reviews laser installation  P: Production and delivery of these lasers both outside and inside the beamline enclosure are required to be completely contained to transport pipes or designated enclosures for the Class 3B and Class 4 lasers  P: Keyed interlock system controlling laser operation as dictated by laser classification  M: Establishing the Laser Contained Area (LCA) limits surrounding areas to remaining below the Maximum Permissible Exposure (MPE) as set by the Laser Safety Officer (LSO).  M: Experimenters take eye exams and sign SOP as determined by the SME.</p>	<p>L: EU  C: L  R: IV</p> <p>L: BEU  C: L  R: IV</p> <p>L: BEU  C: N  R: IV</p>
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Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
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Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.																																		
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<b>Acronyms</b> MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																														
	<b>H</b>	$C \geq 25.0 \text{ rem}$	$C \geq 100 \text{ rem}$	$C \geq 100 \text{ rem}$																														
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	<b>L</b>	$5 \text{ rem} > C$	$25 \text{ rem} > C$	$25 \text{ rem} > C$																														
	<b>N</b>	$0.5 \text{ rem} > C$	$5 \text{ rem} > C$	$5 \text{ rem} > C$																														

**Table 2.3 Radiological – MOI Offsite**

<b>Hazard</b>	<b>Hazard Description</b>	<b>Baseline Qualitative Risk (without controls)</b>	<b>Preventative (P)/ Mitigative (M)</b>	<b>Residual Qualitative Risk (with controls)</b>
Prompt Ionizing Radiation	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Residual activation	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Groundwater Activation	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Surface Water Activation	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Radioactive Water (RAW) Systems	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Air Activation	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Soil Interactions	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:



Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Radioactive waste	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Radioactive Sources	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Radiation Generating Devices (RDGs)	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Non-ionizing Radiation Hazards	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
A			U	EU	BEU																															
Consequences	H	I	I	II	III																															
	M	II	II	III	IV																															
	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																
<b>Acronyms</b> MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	<b>H</b>	C ≥ 25.0 rem	C ≥ 100 rem	C ≥ 100 rem																																
	<b>M</b>	25.0 rem > C ≥ 5 rem	100 rem > C ≥ 25 rem	100 rem > C ≥ 25 rem																																
	<b>L</b>	5 rem > C	25 rem > C	25 rem > C																																
	<b>N</b>	0.5 rem > C	5 rem > C	5 rem > C																																

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Beryllium	<i>Hazard:</i> <i>Particle windows made of Beryllium installed at beam absorbers.</i>	L: U C: L R: III	P: Window designed to be contained by vacuum system. M: Procedures in place to assure appropriate pressure differential across particle windows.	L: EU C: N R: IV
Sulfur Hexafluoride (SF <sub>6</sub> )	<i>Hazard:</i> <i>SF<sub>6</sub> is recognized as a greenhouse gas and electrical discharge into SF<sub>6</sub> can produce toxic substances.</i>	L: A C: L R: III	P: Designated SF <sub>6</sub> -recapture skid to minimize atmospheric releases. P: Compressed gas cylinder located outside the enclosure M: Annual monitoring and reporting of gas use	L: EU C: N R: IV
Fluorinert & Its byproducts	<i>Hazard:</i>	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							
					Likelihood							
			Offsite (MOI)		Onsite-2 (co-located worker)	Onsite-1 (facility worker)						
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)			C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH						
Acronyms			PAC-2 > C ≥ PAC-1		PAC-3 > C ≥ PAC-2	IDLH > C ≥ PEL or TLV <sub>c</sub>						
			PAC-1 > C		PAC-2 > C	PEL or TLV <sub>c</sub> > C						
			C									
			H									
			M									
			L									
			N									

<b>IDLH</b> = Immediately Dangerous to Life and Health <b>MOI</b> = Maximally-exposed Offsite Individual <b>PAC</b> = Protective Action Criteria <b>PEL</b> = Permissible Exposure Limit <b>TLV<sub>c</sub></b> = Threshold Limit Value (ceiling)	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	
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**Table 2.5 Toxic Materials – Onsite 2 Co-located Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Beryllium	<i>Hazard:</i> <i>Particle windows made of Beryllium installed at beam absorbers.</i>	L: U C: L R: III	P: Window designed to be contained by vacuum system. M: <b>Procedures in place to assure appropriate pressure differential across particle windows.</b>	L: EU C: N R: IV
Sulfur Hexafluoride (SF <sub>6</sub> )	<i>Hazard:</i> <i>SF<sub>6</sub> is recognized as a greenhouse gas and electrical discharge into SF<sub>6</sub> can produce toxic substances.</i>	L: A C: L R: III	P: Designated SF <sub>6</sub> -recapture skid to minimize atmospheric releases. P: Compressed gas cylinder located outside the enclosure M: Annual monitoring and reporting of gas use	L: EU C: N R: IV
Fluorinert & Its byproducts	<i>Hazard:</i>	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.																				
<b>Likelihood (L, of event)/year</b> <b>A</b> = Anticipated (L > 1.0E-02) <b>U</b> = Unlikely (1.0E-02 > L > 1.0E-04) <b>EU</b> = Extremely Unlikely (1.0E-04 > L > 1.0E-06) <b>BEU</b> = Beyond Extremely Unlikely (1.0E-06 > L)	<b>Consequence (C, of event)/year</b> <b>H</b> = High <b>M</b> = Moderate <b>L</b> = Low <b>N</b> = Negligible	<b>Risk (R, Qualitative Ranking)</b> <b>I</b> = situation (event) of major concern <b>II</b> = situation (event) of concern <b>III</b> = situation (event) of minor concern <b>IV</b> = situation (event) of minimal concern	<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="2">C</th> <th>H</th> <td style="background-color: #f08080;">I</td> <td style="background-color: #f08080;">I</td> <td style="background-color: #ffff00;">II</td> <td style="background-color: #90ee90;">III</td> </tr> </tbody> </table>				Likelihood				A	U	EU	BEU	C	H	I	I	II	III
		Likelihood																		
		A	U	EU	BEU															
C	H	I	I	II	III															

<b>Control(s) Type</b> <b>P</b> = Preventive (reduce event occurrence likelihood) <b>M</b> = Mitigative (reduces event consequences) <b>Acronyms</b> <b>IDLH</b> = Immediately Dangerous to Life and Health <b>MOI</b> = Maximally-exposed Offsite Individual <b>PAC</b> = Protective Action Criteria <b>PEL</b> = Permissible Exposure Limit <b>TLV<sub>c</sub></b> = Threshold Limit Value (ceiling)	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>						
	<b>H</b>	$C \geq PAC-2$	$C \geq PAC-3$	$C \geq IDLH$		M	II	II	III	IV
	<b>M</b>	$PAC-2 > C \geq PAC-1$	$PAC-3 > C \geq PAC-2$	$IDLH > C \geq PEL$ or $TLV_c$		L	III	III	IV	IV
	<b>L</b>	$PAC-1 > C$	$PAC-2 > C$	$PEL$ or $TLV_c > C$		N	IV	IV	IV	IV
	<b>N</b>	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 2.6 Toxic Materials – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Beryllium	<i>Hazard:</i> <i>Particle windows made of Beryllium installed at beam absorbers.</i>	L: U C: L R: III	P: Window designed to be contained by vacuum system. M: Procedures in place to assure appropriate pressure differential across particle windows.	L: EU C: N R: IV
Sulfur Hexafluoride (SF <sub>6</sub> )	<i>Hazard: Not Applicable</i>	L: C: R:	<i>Not Applicable</i>	L: C: R:
Fluorinert & Its byproducts	<i>Hazard:</i>	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.

<b>Likelihood (L, of event)/year</b> <b>A</b> = Anticipated ( $L > 1.0E-02$ ) <b>U</b> = Unlikely ( $1.0E-02 > L > 1.0E-04$ ) <b>EU</b> = Extremely Unlikely ( $1.0E-04 > L > 1.0E-06$ ) <b>BEU</b> = Beyond Extremely Unlikely ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> <b>H</b> = High <b>M</b> = Moderate <b>L</b> = Low <b>N</b> = Negligible		<b>Risk (R, Qualitative Ranking)</b> <b>I</b> = situation (event) of major concern <b>II</b> = situation (event) of concern <b>III</b> = situation (event) of minor concern <b>IV</b> = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
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	Consequences	H	I	I		II	III																													
		M	II	II		III	IV																													
L		III	III	IV	IV																															
N		IV	IV	IV	IV																															
<b>Control(s) Type</b> <b>P</b> = Preventive (reduce event occurrence likelihood) <b>M</b> = Mitigative (reduces event consequences)	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																
<b>Acronyms</b> <b>IDLH</b> = Immediately Dangerous to Life and Health <b>MOI</b> = Maximally-exposed Offsite Individual <b>PAC</b> = Protective Action Criteria <b>PEL</b> = Permissible Exposure Limit <b>TLV<sub>c</sub></b> = Threshold Limit Value (ceiling)	<b>H</b>	$C \geq PAC-2$	$C \geq PAC-3$	$C \geq IDLH$																																
	<b>M</b>	$PAC-2 > C \geq PAC-1$	$PAC-3 > C \geq PAC-2$	$IDLH > C \geq PEL$ or $TLV_c$																																
	<b>L</b>	$PAC-1 > C$	$PAC-2 > C$	$PEL$ or $TLV_c > C$																																
	<b>N</b>	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 2.7 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.)	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	<i>Hazard:</i>	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.**

<p><b>Likelihood (L, of event)/year</b>  <b>A</b> = Anticipated (<math>L &gt; 1.0E-02</math>)  <b>U</b> = Unlikely (<math>1.0E-02 &gt; L &gt; 1.0E-04</math>)  <b>EU</b> = Extremely Unlikely (<math>1.0E-04 &gt; L &gt; 1.0E-06</math>)  <b>BEU</b> = Beyond Extremely Unlikely (<math>1.0E-06 &gt; L</math>)</p>	<p><b>Consequence (C, of event)/year</b>  <b>H</b> = High  <b>M</b> = Moderate  <b>L</b> = Low  <b>N</b> = Negligible</p>		<p><b>Risk (R, Qualitative Ranking)</b>  <b>I</b> = situation (event) of major concern  <b>II</b> = situation (event) of concern  <b>III</b> = situation (event) of minor concern  <b>IV</b> = situation (event) of minimal concern</p>		<p><b>Risk Matrix</b></p> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
		Likelihood																																		
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Consequences	H	I	I	II	III																															
	M	II	II	III	IV																															
	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
<p><b>Control(s) Type</b>  <b>P</b> = Preventive (reduce event occurrence likelihood)  <b>M</b> = Mitigative (reduces event consequences)  <b>Acronyms</b>  <b>MOI</b> = Maximally-exposed Offsite Individual</p>	<p><b>C</b></p>	<p><b>Offsite (MOI)</b></p>	<p><b>Onsite-2 (co-located worker)</b></p>	<p><b>Onsite-1 (facility worker)</b></p>																																
	<p><b>H</b></p>	<p><b>C</b> ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.</p>	<p><b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.</p>	<p><b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.</p>																																
	<p><b>M</b></p>	<p><b>C</b> ≥ Mild, transient adverse effects.</p>	<p><b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.</p>	<p><b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.</p>																																
	<p><b>L</b></p>	<p>Mild, transient adverse effects &gt; <b>C</b></p>	<p>Minor injuries; no hospitalization &gt; <b>C</b></p>	<p>Minor injuries; no hospitalization &gt; <b>C</b></p>																																
	<p><b>N</b></p>	<p>Consequences less than those for Low Consequence Level</p>	<p>Consequences less than those for Low Consequence Level</p>	<p>Consequences less than those for Low Consequence Level</p>																																

**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 materials (cables, Boxes, Paper, wood cribbing, etc.)	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
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Consequences	H	I	I	II	III																															
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	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																															

		take protective action.			
	<b>M</b>	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.	
	<b>L</b>	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C	
	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	



**Table 2.9 Flammable and Combustible Materials – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible materials (cables, Boxes, Paper, wood cribbing, etc.)	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Flammable Materials (Flammable gas, cleaning materials, etc.)	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
A			U	EU	BEU																															
Consequences	H	I	I	II	III																															
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																
	<b>H</b>	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																
	<b>M</b>	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no	C ≥ Serious injury, no immediate loss of life no																																

			permanent disabilities; hospitalization required.	permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	
	<b>N</b>	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 2.13 Thermal Energy – Onsite-1 Facility Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Bakeout	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Hot Work	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Cryogenics	<i>Hazard:</i>	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		Risk Matrix																															
	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)																																
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	H	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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Consequences	H	I	I	II		III																														
	M	II	II	III	IV																															
	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no	C ≥ Serious injury, no immediate loss of life no																																	

			permanent disabilities; hospitalization required.	permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	
	<b>N</b>	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 2.14 Thermal Energy – Onsite-2 Co-located Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Bakeout	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Hot Work	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Cryogenics	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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	N	IV	IV	IV	IV																															
<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																
	<b>H</b>	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																
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			permanent disabilities; hospitalization required.	permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	
	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	

**Table 2.15 Thermal Energy – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Bakeout	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Hot Work	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Cryogenics	<i>Hazard:</i>	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		Risk Matrix																															
	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)																																
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	H	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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			permanent disabilities; hospitalization required.	permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	
	<b>N</b>	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 2.16 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	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Mobile Shielding	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
	<b>H</b> C ≥ Irreversible, other serious effects,	C ≥ Prompt worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that																																	

<b>Acronyms</b> <b>MOI</b> = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	immediately life-threatening or permanently disabling.	is immediately life-threatening or permanently disabling.	
	<b>M</b>	<b>C</b> ≥ Mild, transient adverse effects.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	
	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	

**Table 2.17 Kinetic Energy – Onsite-2 Co-located Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power tools	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Mobile Shielding	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b>	<b>C</b> <b>H</b>	<b>Offsite (MOI)</b> C ≥ Irreversible, other serious effects, or symptoms which	<b>Onsite-2 (co-located worker)</b> C ≥ Prompt worker fatality or acute injury that is immediately life-	<b>Onsite-1 (facility worker)</b> C ≥ Prompt worker fatality or acute injury that is immediately life-																																

<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an individual's ability to take protective action.	threatening or permanently disabling.	threatening or permanently disabling.	
	<b>M</b>	<b>C</b> ≥ Mild, transient adverse effects.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	

**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	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Pumps and Motors	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Motion Tables	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Mobile Shielding	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	<b>C</b> <b>H</b>	<b>Offsite (MOI)</b> C ≥ Irreversible, other serious effects,	<b>Onsite-2 (co-located worker)</b> C ≥ Prompt worker fatality or acute injury that is	<b>Onsite-1 (facility worker)</b> C ≥ Prompt worker fatality or acute injury that																																

<b>Acronyms</b> <b>MOI</b> = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	immediately life-threatening or permanently disabling.	is immediately life-threatening or permanently disabling.	
	<b>M</b>	<b>C</b> ≥ Mild, transient adverse effects.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	

**Table 2.19 Potential Energy – Onsite-1 Facility Worker**

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

<b>Likelihood (L, of event)/year</b> <b>A</b> = Anticipated ( $L > 1.0E-02$ ) <b>U</b> = Unlikely ( $1.0E-02 > L > 1.0E-04$ ) <b>EU</b> = Extremely Unlikely ( $1.0E-04 > L > 1.0E-06$ ) <b>BEU</b> = Beyond Extremely Unlikely ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> <b>H</b> = High <b>M</b> = Moderate <b>L</b> = Low <b>N</b> = Negligible		<b>Risk (R, Qualitative Ranking)</b> <b>I</b> = situation (event) of major concern <b>II</b> = situation (event) of concern <b>III</b> = situation (event) of minor concern <b>IV</b> = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
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Consequences	H	I	I	II	III																															
	M	II	II	III	IV																															
	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
<b>Control(s) Type</b> <b>P</b> = Preventive (reduce event occurrence likelihood) <b>M</b> = Mitigative (reduces event consequences) <b>Acronyms</b> <b>MOI</b> = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
	<b>H</b> <b>C</b> ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	<b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																	
	<b>M</b> <b>C</b> ≥ Mild, transient adverse effects.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.																																	
	<b>L</b> Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>																																	
	<b>N</b> 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 2.20 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	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Compressed Gasses	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum/ Pressure Vessels/ Piping	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Vacuum Pumps	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Material Handling	<i>Hazard:</i>	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.																							
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible	<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern	<b>Risk Matrix</b>																				
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					Likelihood																		
		A	U	EU	BEU																		
H	I	I	I	II	III																		

<b>Control(s) Type</b> <b>P</b> = Preventive (reduce event occurrence likelihood) <b>M</b> = Mitigative (reduces event consequences) <b>Acronyms</b> <b>MOI</b> = Maximally-exposed Offsite Individual	<b>C</b>	<b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>		M	II	II	III	IV
	<b>H</b>	<b>C</b> ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	<b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<b>C</b> ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.		L	III	III	IV	IV
	<b>M</b>	<b>C</b> ≥ Mild, transient adverse effects.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	<b>C</b> ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.		N	IV	IV	IV	IV
	<b>L</b>	Mild, transient adverse effects > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>	Minor injuries; no hospitalization > <b>C</b>						
	<b>N</b>	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 2.21 Potential Energy – MOI Offsite**

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

<b>Likelihood (L, of event)/year</b> <b>A</b> = Anticipated ( $L > 1.0E-02$ ) <b>U</b> = Unlikely ( $1.0E-02 > L > 1.0E-04$ ) <b>EU</b> = Extremely Unlikely ( $1.0E-04 > L > 1.0E-06$ ) <b>BEU</b> = Beyond Extremely Unlikely ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> <b>H</b> = High <b>M</b> = Moderate <b>L</b> = Low <b>N</b> = Negligible		<b>Risk (R, Qualitative Ranking)</b> <b>I</b> = situation (event) of major concern <b>II</b> = situation (event) of concern <b>III</b> = situation (event) of minor concern <b>IV</b> = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
A			U	EU	BEU																															
Consequences	H	I	I	II	III																															
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<b>Control(s) Type</b> <b>P</b> = Preventive (reduce event occurrence likelihood) <b>M</b> = Mitigative (reduces event consequences) <b>Acronyms</b> <b>MOI</b> = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
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	<b>N</b> 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 2.22 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	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
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	<b>N</b> 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 2.23 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	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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Consequences	H	I	I	II	III																															
	M	II	II	III	IV																															
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	<b>H</b> C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																	
	<b>M</b> 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.																																	
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	<b>N</b> 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 2.24 Magnetic Fields – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Fringe Fields	<i>Hazard:</i>	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.																																				
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	<b>N</b> 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 2.25 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	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics	<i>Hazard:</i>	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		Risk Matrix																															
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Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	H	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	
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**Table 2.26 Other hazards – Onsite-2 Co-located Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics	<i>Hazard:</i>	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		Risk Matrix																															
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Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	H	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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Consequences	H	I	I	II		III																														
	M	II	II	III	IV																															
	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.																																	
L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C																																	

	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	
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**Table 2.27 Other hazards – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces	<i>Hazard:</i>	L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics	<i>Hazard:</i>	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		Risk Matrix																															
	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 ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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		A	U	EU		BEU																														
Consequences	H	I	I	II		III																														
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	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.																																
	L	Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C																																

	<b>N</b>	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	
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**Table 2.28 Access & Egress – Onsite-1 Facility Worker**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
	<b>H</b> C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																	
	<b>M</b> 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.																																	
	<b>L</b> Mild, transient adverse effects > C	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C																																	
	<b>N</b> 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 2.29 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	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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)	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
			Likelihood																																	
A			U	EU	BEU																															
Consequences	H	I	I	II	III																															
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	L	III	III	IV	IV																															
	N	IV	IV	IV	IV																															
<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
	<b>H</b> C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																	
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	<b>N</b> 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 2.30 Access & Egress – MOI Offsite**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress	<i>Hazard:</i>	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.																																				
<b>Likelihood (L, of event)/year</b> 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 ( $1.0E-06 > L$ )	<b>Consequence (C, of event)/year</b> H = High M = Moderate L = Low N = Negligible		<b>Risk (R, Qualitative Ranking)</b> I = situation (event) of major concern II = situation (event) of concern III = situation (event) of minor concern IV = situation (event) of minimal concern		<b>Risk Matrix</b> <table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Likelihood</th> </tr> <tr> <th>A</th> <th>U</th> <th>EU</th> <th>BEU</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Consequences</th> <th>H</th> <td>I</td> <td>I</td> <td>II</td> <td>III</td> </tr> <tr> <th>M</th> <td>II</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <th>L</th> <td>III</td> <td>III</td> <td>IV</td> <td>IV</td> </tr> <tr> <th>N</th> <td>IV</td> <td>IV</td> <td>IV</td> <td>IV</td> </tr> </tbody> </table>			Likelihood				A	U	EU	BEU	Consequences	H	I	I	II	III	M	II	II	III	IV	L	III	III	IV	IV	N	IV	IV	IV	IV
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<b>Control(s) Type</b> P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) <b>Acronyms</b> MOI = Maximally-exposed Offsite Individual	<b>C</b> <b>Offsite (MOI)</b>	<b>Onsite-2 (co-located worker)</b>	<b>Onsite-1 (facility worker)</b>																																	
<b>H</b>	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual’s ability to take protective action.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling.																																	
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	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	
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**Table 2.31 Environmental**

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Airborne	<p><i>Hazard:</i></p> <ul style="list-style-type: none"> <li><i>Airborne release of radionuclides beyond permitted limits.</i></li> <li><i>Discharge of chemicals into onsite surface waters beyond permitted limits.</i></li> </ul>	L: C: R:	See Section I Chapter 04	L: C: R:
Water	<p><i>Hazard:</i></p> <ul style="list-style-type: none"> <li><i>Discharge of radionuclides into onsite surface waters beyond permitted limits.</i></li> <li><i>Discharge of chemicals into onsite surface waters beyond permitted limits.</i></li> </ul>	L: C: R:	See Section I Chapter 04	L: C: R:
Soil	<p><i>Hazard:</i></p> <ul style="list-style-type: none"> <li><i>Radioactive soil in beam loss areas beyond allowable concentrations of radionuclides beyond</i></li> </ul>	L: C: R:	See Section I Chapter 04	L: C: R:

	<p><i>calculated Fermilab limits.</i></p> <ul style="list-style-type: none"><li>• <i>Discharge of chemicals into onsite soils beyond permitted limits.</i></li></ul>			
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