	Risk Tables Description	Baseline Risk	Residual Risk					
6.1	Radiological – Onsite-1 Facility Worker	R: I	R: IV					
6.2	Radiological – Onsite-2 Co-located Worker	R: I	R: IV					
6.3	Radiological – MOI Offsite	R: I	R: IV					
6.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *					
6.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *					
6.6	Toxic Materials – MOI Offsite R: *							
6.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *					
6.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *					
6.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *					
6.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *					
6.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *					
6.12	Electrical Energy – MOI Offsite	R: *	R: *					
6.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *					
6.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *					
6.15	Thermal Energy – MOI Offsite	R: *	R: *					
6.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *					
6.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *					
6.18	Kinetic Energy – MOI Offsite	R: *	R: *					
6.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *					
6.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *					
6.21	Potential Energy – MOI Offsite	R: *	R: *					
6.22	Magnetic Fields – Onsite-1 Facility Worker	R: *	R: *					
6.23	Magnetic Fields – Onsite-2 Co-located Worker	R: *	R: *					
6.24	Magnetic Fields – MOI Offsite	R: *	R: *					
6.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *					
6.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *					
6.27	Other Hazards – MOI Offsite	R: *	R: *					
6.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *					
6.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *					
6.30	Access & Egress – MOI Offsite	R: *	R: *					
6.31	Environmental Hazards	R: *	R: *					

#### Table 6. Summary of Baseline and Residual Risks – Booster Neutrino Beam (BNB)

\* 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 6.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Exposure to residual activation	L: A C: H R: I	<ul> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>P – Radiological Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>M – Radiological Signage and Decay Time Requirements: Signs located in various places throughout the accelerator complex warn of various hazards and occupancy restrictions prior to entry. Furthermore, work may be restricted or prevented until sufficient time has passed such that radiation levels are sufficiently low to allow for safer work to proceed. This mitigation has passive and active components.</li> <li>M – Target Pile Shielding: Material placed between radiation sources in the target pile and the enclosure to be protected. This is a passive mitigation.</li> </ul>	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Groundwater	Hazards:			
Activation	Potential exposure due to construction activities, (e.g., earthmoving).	L: A C: N R: IV	<ul> <li>P – Water Evaluation: Sump water is evaluated to determine the presence of tritium or other activation products to prevent personnel exposure.</li> <li>P – Water Capture: Sump pits/enclosures capture activated water to prevent releases exceeding allowed discharge limits.</li> </ul>	L: EU C: N R: IV
		L: A	M – Facility Designs: Facility designs employ shielding to mitigate the production of activation products in groundwater.	L: U
	Draining of groundwater captured in tanks.	C: N R: IV	<ul> <li>P – Water Sampling: Sump water is periodically sampled, and tank draining is performed by RCTs (specialized training).</li> <li>M – RCTs Drain Tanks: Highly trained personnel (RCTs) employ ALARA principles to mitigate exposures during tank draining activities.</li> </ul>	C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Surface Water	Hazards:			
Activation	Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	<ul> <li>P – Beam Loss Monitoring: Beam loss monitors in enclosures prevent excessive beam loss.</li> <li>M – Radiation Detectors: Radiation detectors in enclosures and berms reduce the amount of activation to surface water, by promptly disabling the beam.</li> <li>M – Shielding: Soil, concrete, and/or steel shielding reduces surface water activation.</li> </ul>	L: U C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	<ul> <li>P – Discharge Limit: Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard.</li> <li>P – Monitoring Potential Sources: Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – Operations Pause: In situations where surface water activation is higher than expected (discovered by monitoring), the facility stops operations until the facility upset condition is resolved.</li> <li>M – Monitoring Surface Water: Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	L: EU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive	Hazard: Persons are exposed, beyond	L: A	P – RAW Key Control System: A key system that prevents personnel	L: BEU
Water (RAW)	regulatory levels, to radioactive water	С: Н	access to radioactive water systems.	C: L
Systems		R: I	<ul> <li>P – Secondary Containment: Engineered containment prevents unintended exposure to contaminated water.</li> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered. Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> <li>M – RCT Or RSO Monitoring: A RWP will specify that a RCT or RSO be present during certain kinds of work or work conditions. The radiological expert can make real time decisions to limit, stop, or prevent radiation exposure to personnel. This is an active mitigation.</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Air Activation	Hazard: Radionuclides in air exceed	L: A		L: EU
	regulatory levels	С: Н	P – Active Air Monitoring: Key issuance to enclosures is restricted until	C: N
		R: I	<ul> <li>after the air monitors show that there is a sufficiently low level of radiation coming from the activated air components.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>M – Air Dilution and Decay Time: The air flow is engineered to dilute the activated air components and provide time for these components to deemed appropriate the values of the value of value</li></ul>	R: IV
			<ul> <li>decay away prior to the release of the air from the enclosure.</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered.</li> <li>Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> <li>M – Target Pile Shielding: Material placed between radiation sources in the target pile and the enclosure to be protected. This is a passive mitigation.</li> </ul>	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Closed Loop Air	Hazard: Radionuclides in air exceed	L: A	P – Active Air Monitoring: Key issuance to enclosures is restricted until	L: BEU
Cooling	regulatory levels leading to potential	С: Н	after the air monitors show that there is an acceptable level of	C: L
	worker exposure	R: I	radiation coming from the activated air components.	R: IV
			<ul> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>P – Air Containment: Engineered containment of the cooling air is used to keep it separate from the breathable air.</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered. Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> <li>M – Target Pile Shielding: Material placed between radiation sources in the target pile and the enclosure to be protected. This is a passive mitigation.</li> </ul>	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Soil Interactions	Hazard: Radionuclides are produced by beam which may contaminate soil near the decay pipe	L: A C: N R: IV	<ul> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>M – Beamline and Beam Dump Designs: The use of beamline designs that include measures to reduce unwanted beam particle losses, along with the use of beam dump (absorber) designs that minimizes radiological leakage through the use of shielding. This is a passive mitigation.</li> <li>M – PPE: A RWP may specify that personal protective equipment be used during certain kinds of work or work conditions. The PPE limits the likelihood of bodily exposure to activated material and contamination. This is an active mitigation.</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered. Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> </ul>	L: U C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Waste	ionizing radiation beyond regulatory levels	C: L R: III	<ul> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>M – Decay Time Requirements: Work may be restricted or prevented until sufficient time has passed such that radiation levels are sufficiently low to allow for safer work to proceed. This is an active mitigation.</li> <li>M – Material Survey and Release Process: Any item exposed to beam-on conditions is surveyed by radiological workers and classified</li> </ul>	C: N R: IV
			appropriately when removed from an enclosure. Items identified for disposal are surveyed and processed by Radiological Control organization personnel in accordance with FRCM Chapter 4. This is an active mitigation.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Contamination	Hazard: Persons are exposed to	L: A	P – Shielding for Activated Contamination: Material placed between	L: BEU
	ionizing radiation beyond regulatory	С: Н	radiation sources and the personnel to be protected.	C: L
	levels	R: I	<ul> <li>P – Radiological Surveying and Cleaning: RCTs and RSOs survey for and clean radiological contamination as part of the RWP process.</li> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>M – Material Survey and Release Process: Any item exposed to beam-on conditions is surveyed by radiological workers and classified appropriately when removed from an enclosure. Items identified for disposal are surveyed and processed by Radiological Control organization personnel in accordance with FRCM Chapter 4. This is an active mitigation.</li> <li>M – PPE: A RWP may specify that personal protective equipment be used during certain kinds of work or work conditions. The PPE limits the likelihood of bodily exposure to activated material and</li> </ul>	R: IV
			contamination. This is an active mitigation.	
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: A	No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this pattern	L: A
	to <sup>7</sup> Be (uptake/committed dose).	C: N	of use by facility.	C: N
		R: IV		R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive	Hazard: Persons are exposed to	L: A	P – Radiological Signage on or Near Source Cabinets: Signs give warning	L: BEU
Sources	ionizing radiation beyond regulatory	С: Н	of the presence of radioactive sources.	C: L
	levels	R: I	<ul> <li>P – Radiological Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>P – Kept Under Lock-and-key: Radioactive sources are kept in locked storage, where key issuance is a controlled process.</li> <li>M – Kept in Storage: Unused radioactive sources are kept in storage, which prevents the close proximity of these sources and people. This is a passive mitigation.</li> <li>M – Shielded Containers: Unused high activity sources are stored within shielded containers. This is a passive mitigation.</li> </ul>	R: IV

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year		Consequence (C, of event)/year		r Risk (R, Qualitative Ranking)		Risk Matrix					
A = Anticipated (L > 1.0E-02)	H = High			I = situation (event) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)	M = Moderate			II = situation (ever	II = situation (event) of concern			A	U	EU	BEU
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)	L = Low			III = situation (event) of minor concern		es	Н	1	I.	Ш	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ouer	М	Ш	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> 25.0 rem		<b>C</b> <sup>3</sup> 100 rem	<b>C</b> <sup>3</sup> 100 rem	Conservation of the servation of the ser	-				
M = Mitigative (reduces event consequences)	М	25.0 rem > <b>C</b> <sup>3</sup> 5 rem	10	00 rem <b>&gt; C</b> <sup>3</sup> 25 rem	100 rem <b>&gt; C</b> <sup>3</sup> 25 rem		N	IV	IV	IV	IV
Acronyms	L	5 rem > <b>C</b>		25 rem <b>&gt; C</b>	25 rem <b>&gt; C</b>						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	0.5 rem > <b>C</b>		5 rem <b>&gt; C</b>	5 rem <b>&gt; C</b>						

## Table 6.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Activation	activation	L: A C: H R: I	<ul> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>P – Radiological Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>M – Radiological Signage and Decay Time Requirements: Signs located in various places throughout the accelerator complex warn of various hazards and occupancy restrictions prior to entry. Furthermore, work may be restricted or prevented until sufficient time has passed such that radiation levels are sufficiently low to allow for safer work to proceed. This mitigation has passive and active components.</li> </ul>	C: L R: IV
			<ul> <li>M – Target Pile Shielding: Material placed between radiation sources in the target pile and the enclosure to be protected. This is a passive mitigation.</li> </ul>	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Groundwater	Hazards:			
Activation	Potential exposure due to construction activities, (e.g., earthmoving).	L: A C: N R: IV L: A	<ul> <li>P – Water Evaluation: Sump water is evaluated to determine the presence of tritium or other activation products to prevent personnel exposure.</li> <li>P – Water Capture: Sump pits/enclosures capture activated water to prevent releases exceeding allowed discharge limits.</li> <li>M – Facility Designs: Facility designs employ shielding to mitigate the production of activation products in groundwater.</li> </ul>	L: EU C: N R: IV L: U
	Draining of groundwater captured in tanks.	C: N R: IV	<ul> <li>P – Water Sampling: Sump water is periodically sampled, and tank draining is performed by RCTs (specialized training).</li> <li>M – RCTs Drain Tanks: Highly trained personnel (RCTs) employ ALARA principles to mitigate exposures during tank draining activities.</li> </ul>	C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Surface Water	Hazards:			
Activation	Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	<ul> <li>P – Beam Loss Monitoring: Beam loss monitors in enclosures prevent excessive beam loss.</li> <li>M – Radiation Detectors: Radiation detectors in enclosures and berms reduce the amount of activation to surface water, by promptly disabling the beam.</li> <li>M – Shielding: Soil, concrete, and/or steel shielding reduces surface water activation.</li> </ul>	L: U C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	<ul> <li>P – Discharge Limit: Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard.</li> <li>P – Monitoring Potential Sources: Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – Operations Pause: In situations where surface water activation is higher than expected (discovered by monitoring), the facility stops operations until the facility upset condition is resolved.</li> <li>M – Monitoring Surface Water: Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	L: EU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive	Hazard: persons are exposed, beyond	L: A	P – RAW Key Control System: A key system that prevents personnel	L: BEU
Water (RAW)	regulatory levels, to radioactive water	С: Н	access to radioactive water systems.	C: L
Systems		R: I	<ul> <li>P – Secondary Containment: Engineered containment prevents unintended exposure to contaminated water.</li> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered. Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> <li>M – RCT Or RSO Monitoring: A RWP will specify that a RCT or RSO be present during certain kinds of work or work conditions. The radiological expert can make real time decisions to limit, stop, or prevent radiation exposure to personnel. This is an active mitigation.</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Air Activation	Hazard: radionuclides in air exceed	L: A	P – Active Air Monitoring: Key issuance to enclosures is restricted until	L: EU
	regulatory levels	С: Н	after the air monitors show that there is a sufficiently low level of	C: N
		R: I	radiation coming from the activated air components.	R: IV
			P – LSM: An LSM allows for real time monitoring of radiation levels	
			during work, and its use is specified in the relevant RWP when deemed appropriate for the work.	
			<ul> <li>M – Air Dilution and Decay Time: The air flow is engineered to dilute the activated air components and provide time for these components to decay away prior to the release of the air from the enclosure.</li> </ul>	
			M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered.	
			Specifically, this includes an operating limit for protons/hr. This is an active mitigation.	
			M – Target Pile Shielding: Material placed between radiation sources in	
			the target pile and the enclosure to be protected. This is a passive	
			mitigation.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Closed Loop Air	Hazard: radionuclides in air exceed	L: A	P – Active Air Monitoring: Key issuance to enclosures is restricted until	L: BEU
Cooling	regulatory levels	С: Н	after the air monitors show that there is an acceptable level of	C: L
		R: I	radiation coming from the activated air components.	R: IV
			<ul> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> </ul>	
			<ul> <li>P – Air Containment: Engineered containment of the cooling air is used to keep it separate from the breathable air.</li> </ul>	
			<ul> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered.</li> </ul>	
			Specifically, this includes an operating limit for protons/hr. This is an active mitigation.	
			M – Target Pile Shielding: Material placed between radiation sources in	
			the target pile and the enclosure to be protected. This is a passive	
			mitigation.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Soil Interactions	Hazard: radionuclides are produced	L: A	P – General and/or Job Specific RWP: A RWP is written by ES&H that	L: U
	which may contaminate ground water	C: N	specifies the work that is permitted to be performed, requirements	C: N
		R: IV	<ul> <li>M – Beamline and Beam Dump Designs: The use of beamline designs that include measures to reduce unwanted beam particle losses, along with the use of beam dump (absorber) designs that minimizes radiological leakage through the use of shielding. This is a passive mitigation.</li> <li>M – PPE: A RWP may specify that personal protective equipment be used during certain kinds of work or work conditions. The PPE limits the likelihood of bodily exposure to activated material and contamination. This is an active mitigation.</li> <li>M – Run Condition: Operating parameters that reduce activation by limiting the total amount of beam that could be delivered. Specifically, this includes an operating limit for protons/hr. This is an active mitigation.</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive	Hazard: persons are exposed to	L: A	P – General and/or Job Specific RWP: A RWP is written by ES&H that	L: EU
Waste	ionizing radiation beyond regulatory	C: L	specifies the work that is permitted to be performed, requirements	C: N
	levels	R: III	to perform the work, and limitations of radiological exposure.	R: IV
			P – LSM: An LSM allows for real time monitoring of radiation levels	
			during work, and its use is specified in the relevant RWP when deemed appropriate for the work.	
			M – Decay Time Requirements: Work may be restricted or prevented	
			sufficiently low to allow for safer work to proceed. This is an active	
			mitigation.	
			M – Material Survey and Release Process: Any item exposed to beam-on	
			conditions is surveyed by radiological workers and classified	
			appropriately when removed from an enclosure. Items identified for	
			disposal are surveyed and processed by Radiological Control	
			organization personnel in accordance with FRCM Chapter 4. This is	
			an active mitigation.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Contamination	Hazard: persons are exposed to	L: A	P – Shielding for Activated Contamination: Material placed between	L:BEU
	ionizing radiation beyond regulatory	С: Н	radiation sources and the personnel to be protected.	C: L
	levels	R: I	<ul> <li>P – Radiological Surveying and Cleaning: RCTs and RSOs survey for and clean radiological contamination as part of the RWP process.</li> <li>P – General and/or Job Specific RWP: A RWP is written by ES&amp;H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P – LSM: An LSM allows for real time monitoring of radiation levels during work, and its use is specified in the relevant RWP when deemed appropriate for the work.</li> <li>M – Material Survey and Release Process: Any item exposed to beam-on conditions is surveyed by radiological workers and classified appropriately when removed from an enclosure. Items identified for disposal are surveyed and processed by Radiological Control organization personnel in accordance with FRCM Chapter 4. This is an active mitigation.</li> <li>M – PPE: A RWP may specify that personal protective equipment be used during certain kinds of work or work conditions. The PPE limits the likelihood of bodily exposure to activated material and</li> </ul>	R: IV
			contamination. This is an active mitigation.	
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: A	No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this	L: A
	to <sup>7</sup> Be (uptake/committed dose).	C: N	pattern of use by facility.	C: N
		R: IV		R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive	Hazard: persons are exposed to	L: A	P – Radiological Signage on or Near Source Cabinets: Signs give warning	L:BEU
Sources	ionizing radiation beyond regulatory	С: Н	of the presence of radioactive sources.	C: L
	levels	R: I	<ul> <li>P – Radiological Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>P – Kept Under Lock-and-key: Radioactive sources are kept in locked storage, where key issuance is a controlled process.</li> <li>M – Kept in Storage: Unused radioactive sources are kept in storage, which prevents the close proximity of these sources and people. This is a passive mitigation.</li> <li>M – Shielded Containers: Unused high activity sources are stored within shielded containers. This is a passive mitigation.</li> </ul>	R: IV

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Cor	nsequence (C, of event)/ye	/ear R	Risk (R, Qualitative Ra	nking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)	H = High			I = situation (event) of major concern					Likelihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)	M = Moderate			II = situation (event) of concern			-	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	tion (event) of minor concern		н	1	I.	Ш	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		Duar	м	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> 25.0 rem		<b>C</b> <sup>3</sup> 100 rem	<b>C</b> <sup>3</sup> 100 rem	Con					
M = Mitigative (reduces event consequences)	м	25.0 rem > <b>C</b> <sup>3</sup> 5 rem	100	rem <b>&gt; C</b> <sup>3</sup> 25 rem	100 rem <b>&gt; C</b> <sup>3</sup> 25 rem		N	IV	IV	IV	IV
Acronyms	L	5 rem > <b>C</b>		25 rem <b>&gt; C</b>	25 rem <b>&gt; C</b>						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	0.5 rem > <b>C</b>		5 rem <b>&gt; C</b>	5 rem <b>&gt; C</b>						

## Table 6.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: exposure to residual activation	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>M – Radiological Shielding to Limit Activation: Material placed between radiation sources and other materials that may come into the close proximity of people. This is a passive mitigation.</li> </ul>	L: BEU C: M R: IV
Groundwater Activation	Hazards: Potential exposure due to construction activities, (e.g., earthmoving). Draining of groundwater captured in tanks.	L: A C: N R: IV L: A C: N R: IV	<ul> <li>P – Water Evaluation: Sump water is evaluated to determine the presence of tritium or other activation products to prevent personnel exposure.</li> <li>P – Water Capture: Sump pits/enclosures capture activated water to prevent releases exceeding allowed discharge limits.</li> <li>M – Facility Designs: Facility designs employ shielding to mitigate the production of activation products in groundwater.</li> <li>P – Water Sampling: Sump water is periodically sampled, and tank draining is performed by RCTs (specialized training).</li> <li>M – RCTs Drain Tanks: Highly trained personnel (RCTs) employ ALARA principles to mitigate exposures during tank draining activities.</li> </ul>	L: EU C: N R: IV L: U C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Surface Water	Hazards:			L: U
Activation	Potential exposure to activated surface water due to beam loss leakage from beam enclosures, located under the surface water impoundment.	L: A C: N R: IV	<ul> <li>P – Beam Loss Monitoring: Beam loss monitors in enclosures prevent excessive beam loss.</li> <li>M – Radiation Detectors: Radiation detectors in enclosures and berms reduce the amount of activation to surface water, by promptly disabling the beam.</li> <li>M – Shielding: Soil, concrete, and/or steel shielding reduces surface water activation.</li> </ul>	C: N R: IV
	Potential exposure to activated surface water due to mixing surface water with a captured groundwater source.	L: A C: N R: IV	<ul> <li>P – Discharge Limit: Off-site discharge limit is applied to any water mixed into onsite surface water. This prevents surface water concentrations from approaching the Derived Concentration Standard.</li> <li>P – Monitoring Potential Sources: Monitoring of potential mixed sources allow for diversion of water, preventing exposure to waters above the Derived Concentration Standard.</li> <li>M – Operations Pause: In situations where surface water activation is higher than expected (discovered by monitoring), the facility stops operations until the facility upset condition is resolved.</li> <li>M – Monitoring Surface Water: Frequent surface water monitoring at many locations to mitigate increases in activity approaching the Derived Concentration Standard.</li> </ul>	L: EU C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Radioactive Water (RAW) Systems	Hazard: persons are exposed, beyond regulatory levels, to radioactive water	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>M – Radiological Shielding to Limit Exposure: Material placed between radiation sources and people, which prevents the close proximity of these sources and people. This is a passive mitigation.</li> </ul>	L: BEU C: M R: IV
Air Activation	Hazard: radionuclides in air exceed regulatory levels	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>M – Controlled Release: The release of activated air is engineered to reduce potential exposure consequences. This is a passive mitigation.</li> </ul>	L: BEU C: M R: IV
Closed Loop Air Cooling	Hazard: radionuclides in air exceed regulatory levels	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>P – Air Containment: Engineered containment of the cooling air is used to keep it separate from the breathable air.</li> <li>M – Controlled Release: The release of activated air is engineered to reduce potential exposure consequences. This is a passive mitigation.</li> </ul>	L: BEU C: M R: IV
Soil Interactions	Hazard: radionuclides are produced which may contaminate ground water	L: BEU C: N R: IV	P – Gates: Public access gates prevent unauthorized access by public.	L: BEU C: N R: IV
Radioactive Waste	Hazard: persons are exposed to ionizing radiation beyond regulatory levels	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>M – Radiological Shielding to Limit Exposure: Material placed between radiation sources and people, which prevents the close proximity of these sources and people. This is a passive mitigation.</li> </ul>	L: BEU C: M R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Contamination	Hazard: persons are exposed to ionizing radiation beyond regulatory levels	L: BEU C: H R: III	<ul> <li>P – Gates: Public access gates prevent unauthorized access by public.</li> <li>M – Radiological Shielding to Limit Exposure: Material placed between radiation sources and people, which prevents the close proximity of</li> </ul>	L: BEU C: M R: IV
72		 	these sources and people. This is a passive mitigation.	 
′Ве	Hazard: Potential radiation exposure to $^{7}$ Pa (untake/committed doca)	L: A	No prevention or mitigation is required. 'Be isn't hazardous in this	L: A
	to be (uptuke/committed dose).	R: IV		R: IV
Radioactive	Hazard: persons are exposed to	L: BEU	P – Gates: Public access gates prevent unauthorized access by public.	L: BEU
Sources	ionizing radiation beyond regulatory	С: Н	M – Kept in Storage: Unused radioactive sources are kept in storage,	C: L
	levels	R: III	<ul> <li>which prevents the close proximity of these sources and people.</li> <li>This is a passive mitigation.</li> <li>M – Shielded Containers: Unused high activity sources are stored within shielded containers. This is a passive mitigation.</li> </ul>	R: IV

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative Ra	nking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	t) of major concern			Likelihood			-
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (ever	nt) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	nt) of minor concern	es	Н	1	1	Ш	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ienc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> 25.0 rem		<b>C</b> <sup>3</sup> 100 rem	<b>C</b> <sup>3</sup> 100 rem	Cons	-				
<b>M</b> = Mitigative (reduces event consequences)	м	25.0 rem > <b>C</b> <sup>3</sup> 5 rem	1	.00 rem <b>&gt; C</b> <sup>3</sup> 25 rem	100 rem <b>&gt; C</b> <sup>3</sup> 25 rem		N	IV	IV	IV	IV
Acronyms	L	5 rem > <b>C</b>		25 rem <b>&gt; C</b>	25 rem <b>&gt; C</b>						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem <b>&gt; C</b>	5 rem <b>&gt; C</b>						

## Table 6.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead	L:	See Section I Chapter 04.	L:
	dust during manual handling of un-	C:		C:
	encased lead bricks, lead shot, and	R:		R:
	lead sheets.			
Beryllium	Hazard: Potential exposure to	L:	See Section I Chapter 04.	L:
	beryllium dust during manual	C:		C:
	handling of un-encased, or machining	R:		R:
	dusts from fabrication shop activities.			

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative R	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)	H = High			I = situation (even	nt) of major concern				Likel	ihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	S	Н	I	I	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	ouər	М	Ш	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (c		Onsite-1 (facility worker)	sequ	L	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> PAC-2		<b>C</b> <sup>3</sup> PAC-3	C <sup>3</sup> IDLH	Con						
M = Mitigative (reduces event consequences)	м	PAC-2 > <b>C</b> <sup>3</sup> PAC-1	F	PAC-3 > C <sup>3</sup> PAC-2	IDLH > C <sup>3</sup> PEL or TLV <sub>c</sub>	•	N	IV	IV	IV	IV	
Acronyms	L	PAC-1 > <b>C</b>		PAC-2 <b>&gt; C</b>	PEL or TLV <sub>c</sub> > C							
<b>IDLH</b> = Immediately Dangerous to Life and Health	Ν	Consequences less	Con	sequences less than	Consequences less than							
MOI = Maximally-exposed Offsite Individual		than those for Low	those	for Low Consequence	those for Low							
<b>PAC</b> = Protective Action Criteria				level	Consequence Level							
PEL = Permissible Exposure Limit												
TLV <sub>c</sub> = Threshold Limit Value (ceiling)												

#### Table 6.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead	L:	See Section I Chapter 04.	L:
	dust during manual handling of un-	C:		C:
	encased lead bricks, lead shot, and	R:		R:
	lead sheets.			
Beryllium	Hazard: Potential exposure to	L:	See Section I Chapter 04.	L:
	beryllium dust during manual	C:		C:
	handling of un-encased, or machining	R:		R:
	dusts from fabrication shop activities.			

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative R	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)	H = High			I = situation (even	nt) of major concern				Likel	ihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	S	Н	1	I	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	ouər	М	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (c		Onsite-1 (facility worker)	sequ	L	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> PAC-2		<b>C</b> <sup>3</sup> PAC-3	C <sup>3</sup> IDLH	Con						
M = Mitigative (reduces event consequences)	м	PAC-2 > <b>C</b> <sup>3</sup> PAC-1	F	PAC-3 > C <sup>3</sup> PAC-2	IDLH > C <sup>3</sup> PEL or TLV <sub>c</sub>	•	N	IV	IV	IV	IV	
Acronyms	L	PAC-1 > <b>C</b>		PAC-2 <b>&gt; C</b>	PEL or TLV <sub>c</sub> > <b>C</b>							
<b>IDLH</b> = Immediately Dangerous to Life and Health	Ν	Consequences less	Con	sequences less than	Consequences less than							
MOI = Maximally-exposed Offsite Individual		than those for Low	those	for Low Consequence	those for Low							
<b>PAC</b> = Protective Action Criteria				level	Consequence Level							
PEL = Permissible Exposure Limit				2010.								
TLV <sub>c</sub> = Threshold Limit Value (ceiling)												

#### Table 6.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Lead	Hazard: Potential exposure to lead	L:	See Section I Chapter 04.	L:
	dust during manual handling of un-	C:		C:
	encased lead bricks, lead shot, and	R:		R:
	lead sheets.			
Beryllium	Hazard: Potential exposure to	L:	See Section I Chapter 04.	L:
	beryllium dust during manual	C:		C:
	handling of un-encased, or machining	R:		R:
	dusts from fabrication shop activities.			

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	)/year Consequence (C, of event)/year			Risk (R, Qualitative R	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (eve	nt) of major concern				Like	ihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern	<u></u>	r –	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	s	Н	I	I.	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	nenc	М	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (co		Onsite-1 (facility worker)	sequ	L	ш	Ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> PAC-2		<b>C</b> <sup>3</sup> PAC-3	C <sup>3</sup> IDLH	ΪÖ						
M = Mitigative (reduces event consequences)	м	PAC-2 > <b>C</b> <sup>3</sup> PAC-1	F	PAC-3 > C <sup>3</sup> PAC-2	IDLH > C <sup>3</sup> PEL or TLV <sub>c</sub>	Ŭ	Ν	IV	IV	IV	IV	
Acronyms	L	PAC-1 > <b>C</b>		PAC-2 <b>&gt; C</b>	PEL or TLV <sub>c</sub> > C							
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV = Threshold Limit Value (ceiling)	N	Consequences less Consequ than those for Low those for L Consequence Level		sequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level							

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Combustible materials (cables, boxes, paper, wood cribbing, etc.)	<ul> <li>Hazards:</li> <li>Hazard: This hazard is a potential facility fire.</li> <li>The presence of excessive combustible materials can pose a hazard stemming from inadequate housekeeping practices.</li> <li>This hazard can add to the fuel load of a potential facility fire.</li> <li>Poor housekeeping can also lead to life safety concerns, such as egress obstructions and tripping hazards.</li> <li>The exposure of the hazard to the</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:

#### Table 6.7 Flammable and Combustible Materials – Onsite -1 Facility Worker

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative R	anking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	nt) of major concern			Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (even	ent) of minor concern	ses	Н	1	1	Ш	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sequ	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Sug	-				
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		Ν	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hos	pitalization required.	hospitalization required.						
	L	Mild, transient	1	Minor injuries; no	Minor injuries; no						
		adverse effects > C	adverse effects > C hospit		hospitalization > C						
	Ν	Consequences less	Consequences less Conseque		Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Combustible	Hazards:			
materials (cables,	This hazard is a potential facility fire.	L:	See Section I Chapter 04.	L:
boxes, paper,		C:		C:
wood cribbing,	The presence of excessive	R:		R:
etc.)	combustible materials can pose a			
	hazard stemming from inadequate			
	housekeeping practices.			
	This hazard can add to the fuel load			
	of a potential facility fire.			
	Poor housekeeping can also lead to			
	life safety concerns, such as egress			
	obstructions and tripping hazards.			
	The exposure of the hazard to the			
	facility worker is of major concern.			

# Table 6.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year		Consequence (C, of event)/year		Risk (R, Qualitative Ranking)		Risk Matrix						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern			1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (event) of minor concern		ses	Н	1	I.	П	Ш	
BEU = Beyond Extremely Unlikely (1.0E-06> L)	N = Negligible		IV = situation (event) of minimal concern		lenc	М	Ш	П	Ш	IV		
Control(s) Type	С	C Offsite (MOI) Onsite		e-2 (co-located worker)	Onsite-1 (facility worker)	sedu	L	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Ö						
M = Mitigative (reduces event consequences)		serious effects, or	or acute injury that is		or acute injury that is		N	IV	IV	IV	IV	
Acronyms		symptoms which	immediately life-		immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or		threatening or							
		individual's ability to	permanently disabling.		permanently disabling.							
		take protective										
action.       M     C <sup>3</sup> Mild, transient     C <sup>3</sup> Seriou       adverse effects.     immediate												
		C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							
			per	rmanent disabilities;	permanent disabilities;							
			hos	pitalization required.	hospitalization required.							
		Mild, transient	1	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	nospitalization > C	hospitalization > C							
		Consequences less	Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

#### Table 6.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Combustible	Hazards:			
materials (cables,	Hazard: This hazard is a potential	L:	See Section I Chapter 04.	L:
boxes, paper,	facility fire.	C:		C:
wood cribbing,		R:		R:
etc.)	Ine presence of excessive			
	hazard stemming from inadequate			
	housekeeping practices.			
	This hazard can add to the fuel load of a potential facility fire.			
	Poor housekeeping can also lead to life safety concerns, such as egress			
	The exposure of the hazard to the			
	facility worker is of major concern.			

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	Consequence (C, of event)/year		Risk (R, Qualitative Ranking)		Risk Matrix						
A = Anticipated (L > 1.0E-02)		H = High		I = situation (event) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)	M = Moderate		II = situation (event) of concern				A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)	L = Low			III = situation (even	ent) of minor concern	lences	Н	1	- I	Ш	Ш	
BEU = Beyond Extremely Unlikely (1.0E-06> L)	N = Negligible			IV = situation (ev	ent) of minimal concern		м	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	1	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	C <sup>3</sup> Prompt worker fatality		<b>C</b> <sup>3</sup> Prompt worker fatality	l ő						
M = Mitigative (reduces event consequences)		serious effects, or	or acute injury that is		or acute injury that is		N	IV	IV	IV	IV	
Acronyms		symptoms which	immediately life-		immediately life-							
<b>MOI =</b> Maximally-exposed Offsite Individual		could impair an	threatening or permanently disabling.		threatening or							
		individual's ability to			permanently disabling.							
		take protective										
		action.										
	м	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
		hos		pitalization required. hospitalization required.								
		Mild, transient	1	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	nospitalization > C	hospitalization > C							
		Consequences less	Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

### Table 6.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Stored Energy	Hazards:			
Exposure	Shock hazard, >50 V, Non-interlocked	L:	See Section I Chapter 04.	L:
	enclosures	C:		C:
		R:		R:
	Arc Flash, Non-interlocked enclosures			
Stored Energy	Hazards:			
Exposure	Shock hazard,>50 V, Interlocked	L:	See Section I Chapter 04.	L:
	enclosure area	C:		C:
		R:		R:
	Arc Flash, Interlocked enclosure area			
High Voltage	Hazards:			
Exposure	Shock hazard, voltage > 50 V, Non-	L:	See Section I Chapter 04.	L:
	interlocked enclosures	C:		C:
		R:		R:
	Arc Flash, Non-interlocked enclosures			
High Voltage	Hazards:			
Exposure	Shock hazard, voltage > 50 V,	L:	See Section I Chapter 04.	L:
	Interlocked enclosures	C:		C:
		R:		R:
	Arc Flash, Interlocked enclosures			
Low Voltage, High	Hazards:			
Current Exposure.	Arc Flash, Non-interlocked enclosures	L:	See Section I Chapter 04.	L:
		C:		C:
	Fire hazard from high current	R:		R:
	causing smoke inhalation and burns.			
Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
-------------------	-------------------------------------	--	--	--
Low Voltage, High	Hazard:			
Current Exposure.	Arc Flash, Interlocked enclosures	L:	See Section I Chapter 04.	L:
		C:		C:
	Fire hazard from high current	R:		R:
	causing smoke inhalation and burns.			

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

Likelihood (L, of event)/year	Co	onsequence (C, of event)/	'year	Risk (R, Qualitative R	anking)	Ris	Matrix	(			
A = Anticipated (L > 1.0E-02)		H = High	-	I = situation (ever	nt) of major concern				Like	lihood	-
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		-	А	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	ses	н	- I	1	Ш	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	l	М	Ш	П	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sequ	L	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> Pr	ompt worker fatality	C <sup>3</sup> Prompt worker fatality	Con	_				
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which immediately life- immediately life-									
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	<b>C</b> <sup>3</sup>	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
			peri	manent disabilities;	permanent disabilities;						
			hosp	bitalization required.	hospitalization required.						
	L	Mild, transient	Ν	/linor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization > C						
		Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

#### Table 6.11 Electrical Energy 1 Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Stored Energy Exposure	<ul> <li>Hazard:</li> <li>Shock hazard, &gt;50 V, Non-interlocked enclosures</li> <li>Arc Flash, Non- interlocked enclosures</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:
Stored Energy Exposure	<ul> <li>Hazard:</li> <li>Shock hazard,&gt;50 V, Interlocked enclosures</li> <li>Arc Flash, Interlocked enclosures</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:
High Voltage Exposure	<ul> <li>Hazard:</li> <li>Shock hazard, voltage &gt; 50 V, Non-interlocked enclosures</li> <li>Arc Flash, Non-interlocked enclosures</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
High Voltage Exposure	<ul> <li>Hazard:</li> <li>Shock hazard, voltage &gt; 50 V, Interlocked enclosures</li> <li>Arc Flash, Interlocked enclosures</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:
Low Voltage, High Current Exposure.	<ul> <li>Hazards</li> <li>Arc Flash, Non- interlocked enclosures</li> <li>Fire hazard from high current causing smoke inhalation and burns service building areas.</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Low Voltage,	Hazard:	L:		L:
High Current		C:	See Section I Chapter 04.	C:
Exposure.	<ul> <li>Arc Flash, Interlocked enclosures</li> <li>Fire hazard from high current causing smoke inhalation and burns, beam line enclosure areas</li> </ul>	R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (eve	I = situation (event) of major concern						
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	1	I.	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	enc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI) Onsite-		e-2 (co-located worker)	Onsite-1 (facility worker)	sequ	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> Irreversible, other <b>C</b> <sup>3</sup> Pro		rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Con	-				
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	Ŭ	N	IV	IV	IV	IV
Acronyms		symptoms which	i	immediately life-	mediately life- immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						

L		Mild, transient	Minor injuries; no	Minor injuries; no
		adverse effects > C	hospitalization > C	hospitalization > C
Ν	I	Consequences less	Consequences less than	Consequences less than
		than those for Low	those for Low Consequence	those for Low
		Consequence Level	Level	Consequence Level

# Table 6.12 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Stored Energy Exposure	Hazard: Shock hazard, >50 V, Arc flash	L: C: R:	See Section I Chapter 04.	L: C: R:
High Voltage Exposure	Hazard: Shock hazard, > 50 V, Arc flash outside	L: C: R:	See Section I Chapter 04.	L: C: R:
Low Voltage, High Current Exposure.	Hazards: N/A	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	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern					lihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		<b>M</b> = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (even	ent) of minor concern	se	Н	1	1	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	м	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI) Onsite-2		e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	L	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	l ő						
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV	
Acronyms		symptoms which	i	immediately life-	immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.							
		take protective										
		action.										
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
			hosp	pitalization required.	hospitalization required.							
	L	Mild, transient	ľ	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	nospitalization > C	hospitalization > C							
	N Consequences less		Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

#### Table 6.13 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Hot Work	<ul> <li>Hazard:</li> <li>Hot work will cause elevated temperatures. If hot work is not supervised, there is a potential for combustibles in the surrounding area to be ignited due to exposure to slag or elevated temperatures. This could lead to excessive heat and burning, which could potentially lead to a fire.</li> <li>The presence of excessive combustible materials can pose a hazard stemming from inadequate housekeeping practices.</li> <li>This hazard can add to the fuel load of a potential fire.</li> <li>The exposure of the hazard to the facility</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:

worker is of major		
concern.		

Other Hazard Consequences, derived from Figure C-1, "	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Co	onsequence (C, of event),	/year	Risk (R, Qualitative R	anking)	Risk	Matrix	-				
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern					Like	ihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern				A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	se	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	ience	М	Ш	П	Ш	IV	
Control(s) Type	С	Offsite (MOI) Onsite-2 (		-2 (co-located worker)	Onsite-1 (facility worker)	edr	1	ш	ш	IV	IV	
P = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	C <sup>3</sup> Pr	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	Suo	-					
M = Mitigative (reduces event consequences)		serious effects, or o		acute injury that is	or acute injury that is	Ŭ	N	IV	IV	IV	IV	
Acronyms		symptoms which ir		mmediately life-	immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an t		threatening or	threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.							
		take protective										
		action.										
	М	C <sup>3</sup> Mild, transient	<b>C</b> <sup>3</sup>	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imm	ediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
			hosp	bitalization required.	hospitalization required.							
	L	Mild, transient	Ν	Ainor injuries; no	Minor injuries; no							
adv		adverse effects > C	h	ospitalization > C	hospitalization > C							
	N Consequences less Cons		sequences less than	Consequences less than								
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

#### Table 6.14 Thermal Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Hot Work	<ul> <li>Hazard:</li> <li>A bakeout will cause elevated temperatures. If the bake out were to not have runaway temperature capabilities, this could lead to excessive heat and burning, which could potentially lead to a fire.</li> <li>The presence of excessive combustible materials can pose a hazard stemming from inadequate housekeeping practices.</li> <li>This hazard can add to the fuel load of a potential fire.</li> <li>The exposure of the hazard to the co-located worker is of minor concern.</li> </ul>	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	ience N	1atrix", DOE-HDBK-116	53-2020.								
Likelihood (L, of event)/year	Co	onsequence (C, of event),	/year	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)								
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	nt) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	S	Н	1	1	П	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	М	Ш	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sequ	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	C <sup>3</sup> Pr	ompt worker fatality	C <sup>3</sup> Prompt worker fatality	Suc							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	Ŭ	N	IV	IV	IV	IV		
Acronyms		symptoms which	i	mmediately life-	immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	М	C <sup>3</sup> Mild, transient	<b>C</b> <sup>3</sup>	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	ediate loss of life no	immediate loss of life no								
			peri	manent disabilities;	permanent disabilities;								
			hosp	italization required.	hospitalization required.								
	L	Mild, transient	Ν	/linor injuries; no	Minor injuries; no								
		adverse effects > C	h	ospitalization > C	hospitalization > C								
	Ν	Consequences less	Con	sequences less than	Consequences less than								
		than those for Low	those	for Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

#### Table 6.15 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Hot Work	Hazards: Hot work will cause elevated temperatures. If hot work is not supervised, there is a potential for combustibles in the surrounding area to be ignited due to exposure to slag or elevated temperatures. This could lead to excessive heat and burning, which could potentially lead to a fire. The presence of excessive combustible materials can pose a hazard stemming from inadequate housekeeping practices. This hazard can add to the fuel load of a potential fire. The exposure of the hazard to the public is of minimal concern.	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	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern				Like	lihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	П	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	ienc	М	П	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Suo	_						
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	0	N	IV	IV	IV	IV		
Acronyms		symptoms which	i	immediately life-	immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	nediate loss of life no	immediate loss of life no								
			per	manent disabilities;	permanent disabilities;								
			hosp	pitalization required.	hospitalization required.								
	L	Mild, transient	ľ	Vinor injuries; no	Minor injuries; no								
		adverse effects > C	adverse effects > C hos		hospitalization > C								
N Consequences less		Con	sequences less than	Consequences less than									
		than those for Low	those	for Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 6.16 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Power Tools	Hazard: Personnel injury due to	L:	See Section I Chapter 04.	L:
	improper use of power tools.	C:		C:
		R:		R:
Pumps and	Hazard: Personnel injury due to	L:	See Section I Chapter 04.	L:
Motors	entrapment/entanglement	C:		C:
		R:		R:
Motion Tables	Hazard: Personnel injury due to pinch	L:	See Section I Chapter 04.	L:
	points, tip-overs, caught in between.	C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	ience N	/latrix", DOE-HDBK-116	3-2020.							
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern				Like	lihood		
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	nenc	М	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Con	_					
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	0	N	IV	IV	IV	IV	
Acronyms		symptoms which	i	immediately life-	immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.							
		take protective										
		action.										
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
			hosp	pitalization required.	hospitalization required.							
	L	Mild, transient	ſ	Vinor injuries; no	Minor injuries; no							
		adverse effects > C	adverse effects > C hos		hospitalization > C							
	N Consequences less Co		Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

## Table 6.17 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Power Tools	Hazard: Personnel injury due to	L:	See Section I Chapter 04.	L:
i ower roois	power tool use (flying debris, struck	C:		C:
	by object).	R:		R:
Pumps and	Hazard: Personnel injury due to	L:	See Section I Chapter 04.	L:
Motors	entrapment/entanglement.	C:		C:
		R:		R:
Motion Tables	Hazard: Personnel injury due to tip-	L:	See Section I Chapter 04.	L:
	overs, caught in between, crushing	C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "	Exan	nple Qualitative Conseque	ence Ma	atrix", DOE-HDBK-116	3-2020.							
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	'year	Risk (R, Qualitative R	anking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	nt) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		-	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	1	I	Ш	Ш	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	enc	М	П	П	ш	IV	
Control(s) Type	C Offsite (MOI) Onsite			2 (co-located worker)	Onsite-1 (facility worker)	nbəs	L	ш	ш	IV	IV	
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	<b>P</b> = Preventive (reduce event occurrence likelihood) <b>H C</b> <sup>3</sup> Irreversible, oth <b>M</b> = Mitigative (reduces event consequences)		C <sup>3</sup> Pro	ompt worker fatality	C <sup>3</sup> Prompt worker fatality	Con	N	IV	IV	IV	IV	
Acronyms		symptoms which	or a im	nmediately life-	immediately life-		1					
MOI = Maximally-exposed Offsite Individual		could impair an	t	threatening or	threatening or							
		individual's ability to	permanently disabling.		permanently disabling.							
		take protective										
		action.										
	М	C <sup>3</sup> Mild, transient	C 3 S	Serious injury, no	C <sup>3</sup> Serious injury, no							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
			hospit	talization required.	hospitalization required.							
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no							
		adverse effects > C	ho	ospitalization > C	hospitalization > C							

## Table 6.18 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Power tools	Hazard: N/A	L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:
Pumps and	Hazard: N/A	L:	See Section I Chapter 04.	L:
Motors		C:		C:
		R:		R:
Motion Tables	Hazard: N/A	L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "	Exan	nple Qualitative Conseque	ence M	atrix", DOE-HDBK-116	3-2020.								
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year	Risk (R, Qualitative R	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	nt) of major concern				Like	ihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		-	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	1	I	Ш	Ш		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	enc	М	П	П	ш	IV		
Control(s) Type	C Offsite (MOI) Onsite			2 (co-located worker)	Onsite-1 (facility worker)	nbəs	L	ш	ш	IV	IV		
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	<b>P</b> = Preventive (reduce event occurrence likelihood) <b>H C</b> <sup>3</sup> Irreversible, c		C <sup>3</sup> Pro	ompt worker fatality	C <sup>3</sup> Prompt worker fatality	Con	N	IV	IV	IV	IV		
Acronyms		symptoms which	or a ir	mmediately life-	immediately life-		1						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	pern	nanently disabling.	permanently disabling.								
		take protective											
		action.											
	м	C <sup>3</sup> Mild, transient	<b>C</b> <sup>3</sup>	Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imme	ediate loss of life no	immediate loss of life no								
			pern	manent disabilities;	permanent disabilities;								
			hospi	italization required.	hospitalization required.								
	L	Mild, transient	Μ	linor injuries; no	Minor injuries; no								
		adverse effects > C	hc	ospitalization > C	hospitalization > C								

## Table 6.19 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: personnel injury due to	L:	See Section I Chapter 04.	L:
	improper crane operations.	C: R:		C: R:
Compressed Gasses	Hazard: Personnel injury due to unexpected release, or unsecure tanks.	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum/ Pressure Vessels/Piping	Hazards: Personnel injury due to unexpected pressure release. Beam pipes under vacuum	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum Pumps	Hazard: Personnel injury due to interaction with existing vacuum.	L: C: R:	See Section I Chapter 04.	L: C: R:
Material Handling	Hazard: Personnel injury due to moving/handing material (rollovers, crush, etc.)	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	uence N	Matrix", DOE-HDBK-116	3-2020.								
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	Ш	Ш		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	lenc	м	П	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	l ő							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV		
Acronyms		symptoms which	symptoms which im		immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	nediate loss of life no	immediate loss of life no								
			per	manent disabilities;	permanent disabilities;								
			hos	pitalization required.	hospitalization required.								
	L	Mild, transient	1	Minor injuries; no	Minor injuries; no								
		adverse effects > C	h	nospitalization > C	hospitalization > C								
	Ν	Consequences less	Con	sequences less than	Consequences less than								
		than those for Low	those	for Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

## Table 6.20 Potential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: Struck by falling, swinging loads	L: C: R:	See Section I Chapter 04.	L: C: R:
Compressed Gasses	Hazard: Collocated personnel injury due to unexpected release, or unsecure tanks	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum/ Pressure Vessels/Piping	Hazards: Collocated personnel injury due to unexpected pressure release. Beam pipes under vacuum	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum Pumps	Hazard: Personnel injury due to interaction with existing vacuum.	L: C: R:	See Section I Chapter 04.	L: C: R:
Material Handling	Hazard: Collocated personnel injury due to moving/handing material (rollovers, crush, etc.)	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	uence N	Matrix", DOE-HDBK-116	3-2020.								
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	Ш	Ш		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	lenc	м	П	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	l ő							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV		
Acronyms		symptoms which	symptoms which in		immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	м	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	nediate loss of life no	immediate loss of life no								
			per	manent disabilities;	permanent disabilities;								
			hos	pitalization required.	hospitalization required.								
	L	Mild, transient	1	Minor injuries; no	Minor injuries; no								
		adverse effects > C	adverse effects > C ho		hospitalization > C								
	Ν	Consequences less	Consequences less Conse		Consequences less than								
		than those for Low	those	for Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

## Table 6.21 Potential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Crane Operations	Hazard: N/A	L: C:	See Section I Chapter 04.	L: C:
Compressed Gasses	Hazard: Injury due to unexpected release, or unsecure tanks outside of buildings	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum/ Pressure Vessels/Piping	Hazard: Injury due to unexpected release, or unsecure tanks outside of buildings	L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum Pumps	Hazard: N/A	L: C: R:	See Section I Chapter 04.	L: C: R:
Material Handling	Hazard: N/A	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	uence N	Matrix", DOE-HDBK-116	3-2020.								
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	Ш	Ш		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	lenc	м	П	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	l ő							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV		
Acronyms		symptoms which	symptoms which in		immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	м	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	nediate loss of life no	immediate loss of life no								
			per	manent disabilities;	permanent disabilities;								
			hos	pitalization required.	hospitalization required.								
	L	Mild, transient	1	Minor injuries; no	Minor injuries; no								
		adverse effects > C	adverse effects > C ho		hospitalization > C								
	Ν	Consequences less	Consequences less Conse		Consequences less than								
		than those for Low	those	for Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

## Table 6.22 Magnetic Fields – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Fringe Fields	Hazard: Exposure to fringe fields beyond allowable limits (worker <b>with</b> ferromagnetic or electronic medical device(s)) Exposure to fringe fields beyond allowable limits (worker <b>without</b> ferromagnetic or electronic medical device(s)) Exposure to flying metallic objects causing potential injury.	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	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix								
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern									
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU			
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	1	I.	П	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	nenc	М	П	П	Ш	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV			
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Suo	_							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	0	N	IV	IV	IV	IV			
Acronyms		symptoms which	symptoms which im		immediately life-									
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or									
		individual's ability to	per	manently disabling.	permanently disabling.									
		take protective												
		action.												
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no									
		adverse effects.	imm	nediate loss of life no	immediate loss of life no									
			per	manent disabilities;	permanent disabilities;									
			hosp	pitalization required.	hospitalization required.									
	L	Mild, transient	ſ	Minor injuries; no	Minor injuries; no									
		adverse effects > C	h	nospitalization > C	hospitalization > C									
	Ν	Consequences less	Con	sequences less than	Consequences less than									
		than those for Low	those	for Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

## Table 6.23 Magnetic Fields – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Fringe Fields	Hazards: Exposure to fringe fields beyond allowable limits (worker <b>with</b> ferromagnetic or electronic medical device(s))	L: C: R:	See Section I Chapter 04.	L: C: R:
	Exposure to fringe fields beyond allowable limits (worker <b>without</b> ferromagnetic or electronic medical device(s))			
	Exposure to figing metallic objects causing potential injury.			

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	uence N	Matrix", DOE-HDBK-116	3-2020.								
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative R	anking)	Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (even	nt) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (even	ent) of minor concern	ses	Н	1	1	Ш	Ш		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	М	П	П	Ш	IV		
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sequ	1	ш	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Sug	-						
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		Ν	IV	IV	IV	IV		
Acronyms		symptoms which	symptoms which in		immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or								
		individual's ability to	per	manently disabling.	permanently disabling.								
		take protective											
		action.											
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no								
		adverse effects.	imm	nediate loss of life no	immediate loss of life no								
			per	manent disabilities;	permanent disabilities;								
			hos	pitalization required.	hospitalization required.								
	L	Mild, transient	1	Minor injuries; no	Minor injuries; no								
		adverse effects > C	h	nospitalization > C	hospitalization > C								
	Ν	Consequences less	Con	sequences less than	Consequences less than								
		than those for Low	those	for Low Consequence those for Low									
		Consequence Level		Level	Consequence Level								

## Table 6.24 Magnetic Fields – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Fringe Fields	Hazards: Exposure to fringe fields beyond allowable limits (worker <b>with</b> ferromagnetic or electronic medical device(s)) Exposure to fringe fields beyond allowable limits (worker <b>without</b> ferromagnetic or electronic medical device(s)) Exposure to flying metallic objects causing potential injury.	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	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix								
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (ever	nt) of major concern									
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU			
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	es	Н	1	I.	П	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	nenc	М	П	П	Ш	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV			
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Suo	_							
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	•	N	IV	IV	IV	IV			
Acronyms		symptoms which	symptoms which im		immediately life-									
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or									
		individual's ability to	per	manently disabling.	permanently disabling.									
		take protective												
		action.												
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no									
		adverse effects.	imm	nediate loss of life no	immediate loss of life no									
			per	manent disabilities;	permanent disabilities;									
			hosp	pitalization required.	hospitalization required.									
	L	Mild, transient	ſ	Minor injuries; no	Minor injuries; no									
		adverse effects > C	h	nospitalization > C	hospitalization > C									
	Ν	Consequences less	Con	sequences less than	Consequences less than									
		than those for Low	those	for Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

#### Table 6.25 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Confined Spaces	Hazards:	L:		L:
	Toxic atmosphere	C:	See Section I Chapter 04.	C:
		R:		R:
	Limited egress			
	Poor quality walking surface			
Noise	Hazard: Exposure above OELs via use	L:		L:
	of machinery, tools, co-location w/	C:	See Section I Chapter 04.	C:
	equipment, etc.	R:		R:
Silica	Hazard: Airborne exposure above	L:		L:
	OEL via concrete (or similar material)	C:	See Section I Chapter 04.	C:
	machining, moving dirt or gravel	R:		R:
Ergonomics	Hazards:	L:		L:
	Office space	C:	See Section I Chapter 04.	C:
		R:		R:
	Industrial space (over lifting,			
	repetitive motion, static posture)			
Working at	Hazard: Falls, dropped tools/material	L:	See Section I Chapter 04.	L:
Heights		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)	H = High		I = situation (event) of major concern				Likelihood					
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (even	III = situation (event) of minor concern		Н	1	1	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)	N = Negligible			IV = situation (ev	ent) of minimal concern	ienc	м	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	C <sup>3</sup> Prompt worker fatality		C <sup>3</sup> Prompt worker fatality	l ü						
M = Mitigative (reduces event consequences)		serious effects, or or symptoms which		acute injury that is	or acute injury that is immediately life-		N	IV	IV	IV	IV	
Acronyms				immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	n threatening or		threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.							
		take protective										
		action.										
		M C <sup>3</sup> Mild, transient adverse effects. in		<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
				nediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
		hos		pitalization required.	hospitalization required.							
		Mild, transient	1	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	nospitalization > C	hospitalization > C							
	Ν	Consequences less	Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

#### Table 6.26 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Confined Spaces	Hazard:	L:	See Section I Chapter 04.	L:
	Toxic atmosphere	C:		C:
	Accidental entry	R:		R:
Noise	Hazard: Exposure above OELs via use	L:	See Section I Chapter 04.	L:
	of machinery, tools, co-location w/	C:		C:
	equipment, etc.	R:		R:
Silica	Hazard: Airborne exposure above	L:	See Section I Chapter 04.	L:
	OEL via concrete (or similar material)	C:		C:
	machining, moving dirt or gravel	R		R
Ergonomics	Hazard: N/A	L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:
Working at	Hazard: Struck by dropped	L:	See Section I Chapter 04.	L:
Heights	tools/material	C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking)			Risk Matrix					
A = Anticipated (L > 1.0E-02)	H = High			I = situation (event) of major concern				Likelihood				
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	= situation (event) of minor concern		Н	1	1	П	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)	N = Negligible			IV = situation (even	ent) of minimal concern	ienc	м	П	П	Ш	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	L	ш	ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	C <sup>3</sup> Prompt worker fatality		C <sup>3</sup> Prompt worker fatality	l ü						
M = Mitigative (reduces event consequences)		serious effects, or or symptoms which		acute injury that is	or acute injury that is immediately life-		N	IV	IV	IV	IV	
Acronyms				immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	d impair an threatening or		threatening or							
		individual's ability to	per	manently disabling.	permanently disabling.							
		take protective										
		action.										
		M C <sup>3</sup> Mild, transient adverse effects. ir		<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no							
				nediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
		hos		pitalization required.	hospitalization required.							
		Mild, transient	1	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	nospitalization > C	hospitalization > C							
	Ν	Consequences less	Con	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							
### Table 6.27 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Confined Spaces	Hazards: Toxic atmosphere	L: C: R:	See Section I Chapter 04.	L: C: R:
	Accidental entry			
Noise	Hazard: Exposure above OELs via use of machinery, tools, co-location w/ equipment, etc.	L: C: R:	See Section I Chapter 04.	L: C: R:
Silica	Hazard: Airborne exposure above OEL via concrete (or similar material) machining, moving dirt or gravel	L: C: R:	See Section I Chapter 04.	L: C: R:
Ergonomics	Hazard: N/A	L: C: R:	See Section I Chapter 04.	L: C: R:
Working at Heights	Hazard: Struck by dropped tools/material	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	ience N	Matrix", DOE-HDBK-116	3-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative Ranking) Risk Matrix							
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		<b>M</b> = Moderate		II = situation (eve	II = situation (event) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (even	ent) of minor concern	se	Н	1	I	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	n (event) of minimal concern		м	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (		Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	C <sup>3</sup> Prompt worker fatality	l ő					
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which im		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or		threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
		Mild, transient	ľ	Minor injuries; no	Minor injuries; no						
		adverse effects > C	h	nospitalization > C	hospitalization > C						
	Ν	Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

# Table 6.28 Access & Egress – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Life Safety Egress	Hazards:	L:	See Section I Chapter 04.	L:
	A blocked egress would be of major	C:		C:
	life safety concern.	R:		R:
	An egress might be blocked due to			
	construction work, poor			
	housekeeping, or faulty doors.			
	In the event of a fire or other life-			
	threatening event, a blocked egress			
	would be life threatening.			
	The exposure of the hazard to the			
	facility worker is of major concern.			

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	ience N	/latrix", DOE-HDBK-116	3-2020.						
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern				A	U	EU	BEU
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	ienc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI) Onsite-2 (		e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Suo	_				
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	0	N	IV	IV	IV	IV
Acronyms		symptoms which imm		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or		threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
		Mild, transient	ſ	Vinor injuries; no	Minor injuries; no						
		adverse effects > C	h	nospitalization > C	hospitalization > C						
	Ν	Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

# Table 6.29 Access & Egress – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Life Safety Egress	Hazards:	L:	See Section I Chapter 04.	L:
	A blocked egress would be of major	C:		C:
	life safety concern.	R:		R:
	An egress might be blocked due to			
	construction work, poor			
	nousekeeping, or jaulty doors.			
	In the event of a fire, a blocked			
	egress would be life threatening.			
	The exposure of the hazard to the co-			
	located worker is of concern.			

Other Hazard Consequences, derived from Figure C-1, "I	Exan	nple Qualitative Consequ	ience N	/latrix", DOE-HDBK-116	3-2020.						
Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern				A	U	EU	BEU
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	ses	Н	1	1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (even	ent) of minimal concern	ienc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI) Onsite-2 (		e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	1	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	<b>C</b> <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> P	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Suo	_				
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	0	N	IV	IV	IV	IV
Acronyms		symptoms which imm		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or		threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	C	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
		Mild, transient	ſ	Vinor injuries; no	Minor injuries; no						
		adverse effects > C	h	nospitalization > C	hospitalization > C						
	Ν	Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

# Table 6.30 Access & Egress – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Life Safety Egress	Hazard: N/A	L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "F	Exan	nple Qualitative Consequ	uence N	/latrix", DOE-HDBK-116	3-2020.						
Likelihood (L, of event)/year	Со	nsequence (C, of event)	/year	Risk (R, Qualitative Ra	anking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		<b>H</b> = High		I = situation (event) of major concern				Likelihood			
<b>U</b> = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			A	U	EU	BEU
<b>EU</b> = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (eve	ent) of minor concern	s	Н	I	I.	Ш	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	ienc	М	Ш	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sequ	L	ш	ш	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	н	C <sup>3</sup> Irreversible, other	<b>C</b> <sup>3</sup> Pr	rompt worker fatality	<b>C</b> <sup>3</sup> Prompt worker fatality	Son					
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is	•	N	IV	IV	IV	IV
Acronyms		symptoms which	i	immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an thr		threatening or	threatening or						
		individual's ability to permane		manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C <sup>3</sup> Mild, transient	<b>C</b> <sup>3</sup>	<sup>3</sup> Serious injury, no	C <sup>3</sup> Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
		Mild, transient	Ν	Ainor injuries; no	Minor injuries; no						
	adverse effects > C		h	ospitalization > C	hospitalization > C						
	Ν	Consequences less Consec		sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

### Table 6.31 Environmental

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/Mitigative (M) Credited Controls Are In Bold	Residual Qualitative Risk (with controls)
Airborne	Hazards:	L:	See Section I Chapter 04.	L:
	Airborne release of radionuclides	C:		C:
	beyond permitted limits	R:		R:
	Airborne release of chemicals beyond			
	permitted limits (consequence based			
	on Onsite Worker qualitative			
	consequence matrix)			
Water	Hazards:	L:	See Section I Chapter 04.	L:
	Discharge of radionuclides into	C:		C:
	onsite waters beyond permitted	R:		R:
	limits			
	Discharge of chemicals into onsite waters beyond permitted limits (Consequence based on Onsite			
	worker qualitative consequence matrix)			
Soil	Hazards:	L:	See Section I Chapter 04.	L:
	Radioactive soil in beam loss areas	C:		C:
	beyond allowable concentrations of	R:		R:
	radionuclides above Fermilab limits			
	Discharge of chemicals into onsite soils beyond RCRA limits (Consequence based on Onsite			

worker qualitative consequence		
matrix)		