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

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

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

NOTE:

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

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

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

Table 2.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt	Hazard:	L: A	P: Shielding in place around the beam line and experiment	L: BEU
Ionizing	Prompt ionizing radiation levels	C: H	enclosures per the relevant shield assessments	C: N
Radiation	inside and surrounding the enclosures that are present during operation. The radiation may include neutrons and other energetic particles.	R: I	 P: Interlock system preventing access to beam enclosure while beam is present. P: Enclosure keys linked to radiological and controlled access training to enter enclosure P: Search and secure of beam enclosure by main control room prior to beam delivery M: Dosimetry as required by the relevant RWP M: Audible alarm when enclosure is interlocked before beam is delivered 	R: IV
Residual activation	Hazard: Electron absorber surfaces and the associated vacuum windows immediately upstream along with beamline components may be radioactive even when the electron beamline is not in operation.	L: A C: N R: IV	 P: Enclosure keys linked to radiological and controlled access training to enter enclosure M: Any item in a beam enclosure during beam-on conditions is removed and surveyed by radiological workers and classified appropriately M: Any item requiring shipment or unrestricted release is surveyed and processed by Radiological Control organization personnel in accordance with FRCM chapter 4. M: Dosimetry as required by the relevant RWP M: Enclosure surveys as required by the relevant RWP M: PPE as required by the relevant RWP 	L: U C: N R: IV

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

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

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

Non-ionizing	Hazard:	L: A	P: Painted Lead shielding specifically designed for each klystron.	L: EU
Radiation	Hazardous levels of radio	С: Н	P: Antennae have been installed in the controls racks for each RF	C: L
Hazards	frequency electromagnetic energy are generated by the RF power	R: I	system to monitor leakage and automatically shut off the appropriate RF system.	R: IV
	sources (Klystrons) for the		M - Specific "Lock-out/Tag-out" (LOTO) and configuration control	
	IOTA/FAST Facility Electron		procedures are in place to establish safe conditions for personnel	
	Injector.		working on or around these systems.	
			M: Periodic surveys for stray RF fields are also performed by	
			Fermilab ES&H Section.	
		L: A		L: BEU
	Hazard:	C: M	P: Concrete shielding blocks to reduce dose rates below	C: L
	Radiofrequency accelerating	R: I	1.0mrem/hour at all energies.	R: IV
	structures, including those used in		P: Enclosure keys linked to radiological and controlled access	
	the IOTA/FAST Facility, may		training to enter enclosure	
	generate electromagnetic fields of		P: The safety interlock system for the IOTA/FAST Facility ADRDA	
	sufficient amplitude to generate		enclosure disables RF power to the cavities thereby mitigating the	
	'dark-current' electrons of		x-ray hazard whenever personnel access the enclosure.	
	sufficient energy to produce x-		M: Radiological worker training	
	rays.	L: A		L: BEU
		С: Н	P: Subject Matter Expert (SME) reviews laser installation	C: N
	Hazard:	R: I	P: Production and delivery of these lasers both outside and inside	R: IV
	Class 3B and Class 4, near-		the beamline enclosure are required to be completely contained to	
	infrared, UV, and visible lasers will		transport pipes or designated enclosures for the Class 3B and Class	
	be used in the IOTA/FAST Facility		4 lasers	
	for purposes such as electron		P: Keyed interlock system controlling laser operation as dictated by	
	production, beam diagnostics,		laser classification	
	beam instrumentation, and		M: Establishing the Laser Contained Area (LCA) limits surrounding	
	dedicated studies.		areas to remaining below the Maximum Permissible Exposure	
			(MPE) as set by the Laser Safety Officer (LSO).	
			M: Experimenters take eye exams and sign SOP as determined by	
			the SME.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
			M: Special training for experimenters M: PPE as determined by SOP	

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year Co		onsequence (C, of event)/year		Risk (R, Qualitative Ranking)		Risk Matrix					
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	I = situation (event) of major concern				Likelihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (even	nt) of concern	-	1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)	$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	ses	Н	Ι	Ι	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	М	II	Π	III	IV
Control(s) Type	С	Offsite (MOI)	Onsi	ite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T			TT Z	
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge 25.0 \text{ rem}$		$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L	ш	III	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	1	00 rem > $C \ge 25$ rem	100 rem > $\mathbf{C} \ge 25$ rem	C	Ν	IV	IV	IV	IV
Acronyms	L	5 rem $>$ C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	5 rem > C						

Table 2.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Prompt	Hazard:	L: A	P: Shielding in place around the beam line and experiment	L: BEU
Ionizing	Prompt ionizing radiation levels	С: Н	enclosures per the relevant shield assessments	C: N
Radiation	inside and surrounding the	R: I	P: Interlock system preventing access to beam enclosure while	R: IV
	enclosures that are present during		beam is present.	
	operation. The radiation may		P: Enclosure keys linked to radiological and controlled access	
	include neutrons and other		training to enter enclosure	
	energetic particles.		P: Search and secure of beam enclosure by main control room prior	
			to beam delivery	
			M: Dosimetry as required by the relevant RWP	
			M: Audible alarm when enclosure is interlocked before beam is delivered	
Residual	Hazard:	L: A	P: Enclosure keys linked to radiological and controlled access	L: U
activation	Electron absorber surfaces and the	C: N	training to enter enclosure	C: N
	associated vacuum windows	R: IV		R: IV
	immediately upstream along with		M: Any item in a beam enclosure during beam-on conditions is	
	beamline components may be		removed and surveyed by radiological workers and classified appropriately	
	electron begining is not in			
	operation		M: Any item requiring shipment or unrestricted release is surveyed	
			and processed by Radiological Control organization personnel in accordance with FRCM chapter 4.	
			M: Dosimetry as required by the relevant RWP	
			M: Enclosure surveys as required by the relevant RWP	
			M: PPE as required by the relevant RWP	

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

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

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

Non-ionizing	Hazard:	L: A	P: Painted Lead shielding specifically designed for each klystron.	L: EU
Radiation	Hazardous levels of radio	С: Н	P: Antennae have been installed in the controls racks for each RF	C: L
Hazards	frequency electromagnetic energy are generated by the RF power	R: I	system to monitor leakage and automatically shut off the appropriate RF system.	R: IV
	sources (Klystrons) for the		M - Specific "Lock-out/Tag-out" (LOTO) and configuration control	
	IOTA/FAST Facility Electron		procedures are in place to establish safe conditions for personnel	
	Injector.		working on or around these systems.	
			M - Periodic surveys for stray RF fields are also performed by	
			Fermilab ES&H Section.	
		L: A		L: BEU
	Hazard:	C: M	P: Concrete shielding blocks to reduce dose rates below	C: L
	Radiofrequency accelerating	R: I	1.0mrem/hour at all energies.	R: IV
	structures, including those used in		P: Enclosure keys linked to radiological and controlled access	
	the IOTA/FAST Facility, may		training to enter enclosure	
	generate electromagnetic fields of		P: The safety interlock system for the IOTA/FAST Facility ADRDA	
	sufficient amplitude to generate		enclosure disables RF power to the cavities thereby mitigating the	
	'dark-current' electrons of		x-ray hazard whenever personnel access the enclosure.	
	sufficient energy to produce x-		M: Radiological worker training	
	rays.	L: A		L: BEU
		С: Н	P: Subject Matter Expert (SME) reviews laser installation	C: N
	Hazard:	R: I	P: Production and delivery of these lasers both outside and inside	R: IV
	Class 3B and Class 4, near-		the beamline enclosure are required to be completely contained to	
	infrared, UV, and visible lasers will		transport pipes or designated enclosures for the Class 3B and Class	
	be used in the IOTA/FAST Facility		4 lasers	
	for purposes such as electron		P: Keyed interlock system controlling laser operation as dictated by	
	production, beam diagnostics,		laser classification	
	beam instrumentation, and		M: Establishing the Laser Contained Area (LCA) limits surrounding	
	dedicated studies.		areas to remaining below the Maximum Permissible Exposure	
			(MPE) as set by the Laser Safety Officer (LSO).	
			M: Experimenters take eye exams and sign SOP as determined by	
			the SME.	

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
			M: Special training for experimenters M: PPE as determined by SOP	

Radiological Hazard Consequences, derived from Figu	Radiological 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)/y	year	Risk (R, Qualitative R	anking)	Risk Matrix								
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	t) of major concern				Like	lihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (even	nt) of concern	-	1	Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	ses	Н	Ι	Ι	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	situation (event) of minimal concern		М	II	Π	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T			TT Z	TT Z			
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge 25.0$ rem		$C \ge 100 \text{ rem}$	$C \ge 100 \text{ rem}$	ons	L	ш	III	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)	Μ	25.0 rem > $\mathbf{C} \ge 5$ rem	1	$00 \text{ rem} > C \ge 25 \text{ rem}$	100 rem > $\mathbf{C} \ge 25$ rem	0	Ν	IV	IV	IV	IV			
Acronyms	L	5 rem > C		25 rem > C	25 rem > C									
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	Ν	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	5 rem > C									

Table 2.3 Radiological – MOI Offsite

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

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

Radiological Hazard Consequences, derived from Figu	Radiological 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)/y	ear	Risk (R, Qualitative R	anking)	Risk Matrix								
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	t) of major concern									
U = Unlikely (1.0E-02> L >1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (even	nt) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (eve	ent) of minor concern	es	Н	Ι	Ι	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	ent) of minimal concern	enc	М	II	Π	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	nbə	÷							
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		$C \ge 100 \text{ rem}$	C ≥ 100 rem	ons	L	III	III	IV	IV			
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	Μ	$25.0 \text{ rem} > C \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbb{C} \ge 25 \text{ rem}$	100 rem > $\mathbf{C} \ge 25$ rem	0	Ν	IV	IV	IV	IV			
MOI - Maximally avaged Officite Individual	L	5 rem $>$ C		25 rem > C	25 rem > C									
rem = Roentgen equivalent man	N	$0.5 \text{ rem} > \mathbf{C}$		$5 \text{ rem} > \mathbf{C}$	$5 \text{ rem} > \mathbf{C}$									

Table 2.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard:	L: C: R:	See Section I Chapter 04	L: C: R:
Beryllium	Hazard: Particle windows made of Beryllium installed at beam absorbers.	L: U C: L R: III	P: Window designed to be contained by vacuum system. M: Procedures in place to assure appropriate pressure differential across particle windows.	L: EU C: N R: IV
Sulfur Hexafluoride (SF ₆₎	Hazard: SF ₆ is recognized as a greenhouse gas and electrical discharge into SF ₆ can produce toxic substances.	L: A C: L R: III	 P: Designated SF₆-recapture skid to minimize atmospheric releases. P: Compressed gas cylinder located outside the enclosure M: Annual monitoring and reporting of gas use 	L: EU C: N R: IV
Fluorinert & Its byproducts	Hazard:	L: C: R:	See Section I Chapter 04	L: C: R:

Chemical Hazard Consequences, derived from Figure	Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event))/year	Risk (R, Qualitative	Ranking)	Risk	x Matri	X				
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$		I = situation (eve	I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (ev	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	es	Η	Ι	Ι	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	(event) of minimal concern		М	II	Π	III	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəş	т	ш	ш	W	IV	
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge PAC-2$		$C \ge PAC-3$	C≥IDLH	Ons	L			1 V	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		$PAC-2 > C \ge PAC-1$	PA	$AC-3 > C \ge PAC-2$	IDLH > $C \ge PEL$ or TLV_c		Ν	IV	IV	IV	IV	
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$]						

IDLH = Immediately Dangerous to Life and Health	Ν	Consequences less	Consequences less than	Consequences less than
MOI = Maximally-exposed Offsite Individual		than those for Low	those for Low Consequence	those for Low
PAC = Protective Action Criteria		Consequence Level	Level	Consequence Level
PEL = Permissible Exposure Limit				
TLV _c = Threshold Limit Value (ceiling)				

 Table 2.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead	Hazard:	L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Beryllium	Hazard:	L: U	P: Window designed to be contained by vacuum system.	L: EU
	Particle windows made of	C: L	M: Procedures in place to assure appropriate pressure differential	C: N
	Beryllium installed at beam	R: III	across particle windows.	R: IV
	absorbers.			
Sulfur	Hazard:	L: A	P: Designated SF ₆ -recapture skid to minimize atmospheric releases.	L: EU
Hexafluoride	<i>SF</i> ₆ is recognized as a greenhouse	C: L	P: Compressed gas cylinder located outside the enclosure	C: N
(SF ₆₎	gas and electrical discharge into	R: III	M: Annual monitoring and reporting of gas use	R: IV
	SF ₆ can produce toxic substances.			
Fluorinert & Its	Hazard:	L:		L:
byproducts		C:	See Section I Chapter 04	C:
		R:		R:

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 Ranking)	Diale	Matuir								
A = Anticipated (L > 1.0E-02)	$\mathbf{H} = \mathrm{High}$	$\mathbf{I} = $ situation (event) of major concern		wratrix	ikalihaad							
U = Unlikely (1.0E-02 > L > 1.0E-04)	$\mathbf{M} = \mathbf{M}$ oderate	II = situation (event) of concern		F	А	U	EU	BEU				
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)	$\mathbf{L} = \mathbf{Low}$	III = situation (event) of minor concern	U a	н	I	J	П	III				
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$	N = Negligible	IV = situation (event) of minimal concern		11		-	-11					

Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	М	II	II	III	IV
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge PAC-2$	C ≥ PAC-3	C≥IDLH	т	ш	ш	īV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	М	$PAC-2 > C \ge PAC-1$	$PAC-3 > C \ge PAC-2$	IDLH > $C \ge PEL$ or TLV_c	L			1 V	1 V
Acronyms IDI H = Immediately Dangerous to Life and Health	L	PAC-1 > C	PAC-2 > C	PEL or $TLV_c > C$	Ν	IV	IV	IV	IV
MOI = Maximally-exposed Offsite Individual	Ν	Consequences less	Consequences less than	Consequences less than					
PAC = Protective Action Criteria PEL = Permissible Exposure Limit		Consequence Level	Level	Consequence Level					
TLV _c = Threshold Limit Value (ceiling)									

Table 2.6 Toxic Materials – MOI Offsite

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

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

Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Ris	k Matri	X	<u> </u>				
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	I = situation (event) of major concern				Likelihood				
U = Unlikely (1.0E-02>L>1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (evolution)	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	III = situation (event) of minor concern			Ι	Ι	Π	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV		
Control(s) Type	С	Offsite (MOI)	Offsite (MOI)Onsite-2 (co-located worker) $C \ge PAC-2$ $C \ge PAC-3$ $PAC-2 > C \ge PAC-1$ $PAC-3 > C \ge PAC-2$		Onsite-1 (facility worker)	nbə	T		TTT	11 7	TT /		
P = Preventive (reduce event occurrence likelihood)	Н	C > PAC-2			C > IDLH	ons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)	м	$PAC_{-2} > C > PAC_{-1}$			DIH > C > PEL or TLV	Ö	Ν	IV	IV	IV	IV		
Acronyms	T	$\frac{1}{1} \frac{1}{2} \frac{1}{2} \frac{1}{1} \frac{1}{1} \frac{1}{2} \frac{1}{1} \frac{1}$	17	$\frac{10-32}{2} C \ge 1AC-2}{2}$	$\frac{1}{10} \frac{1}{10} \frac$								
IDLH = Immediately Dangerous to Life and Health		PAC-1>C	~	PAC-2>C	PEL OF ILV _c > C								
MOI = Maximally-exposed Offsite Individual	Ν	Consequences less	Cor	nsequences less than	Consequences less than								
PAC = Protective Action Criteria		than those for Low	than those for Low those for L		those for Low								
$\mathbf{PFL} = \mathbf{Permissible Exposure Limit}$		Consequence Level		Level	Consequence Level								
TLV_c = Threshold Limit Value (ceiling)													

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard:	L:	See Section I Chapter 04	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
Flammable	Hazard:	L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	С	onsequence (C, of event)/	/year Ris	Risk (R, Qualitative Ranking)			Risk Matrix					
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		I = situation (event) of major concern					Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (eve	ent) of concern		1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Н	I	Ι	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV	
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co	co-located worker)	Onsite-1 (facility worker)	nbə	×					
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} > $ Irreversible.	$\mathbf{C} > \text{Prom}$	nt worker fatality	$\mathbf{C} > \text{Prompt worker}$	ons	L	III	III	IV	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or acute	e injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	imme	ediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threatenin	g or permanently	threatening or							
		individual's ability to	d	lisabling.	permanently disabling.							
		take protective		8	1 5 8							
		action.										
	М	$C \ge Mild$, transient	$\mathbf{C} \ge \mathbf{Ser}$	rious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	immedia	te loss of life no	immediate loss of life no							
			permane	ent disabilities;	permanent disabilities;							
			hospitali	ization required.	hospitalization required.							
	L	Mild, transient Mi		or injuries; no	Minor injuries; no							
		adverse effects > C hosp		talization > C	hospitalization > C							
	Ν	Consequences less Conseq		uences less than	Consequences less than							
		than those for Low	those for L	Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

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

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard:	L:	See Section I Chapter 04	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
<u>Flavensekla</u>	11 month	1.	Cas Casting L Charter 04	1.
Flammable	Hazara:	L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	С	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Like	lihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (ev	ent) of concern	-	1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	Π	III	
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	Π	II	III	IV	
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	equ	т		ш	πı	11.7	
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq$ Irreversible.	$\mathbf{C} \ge \mathbf{F}$	Prompt worker fatality	$\mathbf{C} \geq \text{Prompt worker}$	ons	L	111	ш	IV	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or	acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	i	immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	could impair an threate		threatening or							
		individual's ability to		disabling.	permanently disabling.							

	take protective		
	action.		
Μ	$C \ge Mild$, transier	t $C \ge$ Serious injury, no	$C \ge$ Serious injury, no
	adverse effects.	immediate loss of life no	immediate loss of life no
		permanent disabilities;	permanent disabilities;
		hospitalization required.	hospitalization required.
L	Mild, transient	Minor injuries; no	Minor injuries; no
	adverse effects >	C hospitalization > C	hospitalization $> C$
Ν	Consequences les	S Consequences less than	Consequences less than
	than those for Lov	those for Low Consequence	those for Low
	Consequence Lev	el Level	Consequence Level

Table 2.9 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard:	L:	See Section I Chapter 04	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
Flammable	Hazard:	L:	See Section I Chapter 04	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	nt) of major concern					Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation} (\text{ev})$	ent) of concern				А	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es		Н	Ι	Ι	Π	III
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible		IV = situation (ev	vent) of minimal concern	enc		М	II	Π	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	egu	-	T.		TTT	177	TV /
P = Preventive (reduce event occurrence likelihood)		H $\mathbf{C} \ge$ Irreversible. $\mathbf{C} \ge$ Pron		Prompt worker fatality	$C \ge Prompt worker$			L	ш	III	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects. or acu		acute injury that is	fatality or acute injury that		Ο _N		IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective										
		action.										
	М	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							

		permanent disabilities;	permanent disabilities;
		hospitalization required.	hospitalization required.
L	Mild, transient	Minor injuries; no	Minor injuries; no
	adverse effects > C	hospitalization $> C$	hospitalization $> C$
N	Consequences less	Consequences less than	Consequences less than
	than those for Low	those for Low Consequence	those for Low
	Consequence Level	Level	Consequence Level

Table 2.13 Thermal Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		I = situation (eve	ent) of major concern				Like	lihood	_
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (ev	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	es	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	Π	III	IV
Control(s) Type	С	C Offsite (MOI) Onsite-2		e-2 (co-located worker)	Onsite-1 (facility worker)	edu	x				
P = Preventive (reduce event occurrence likelihood)		C > Irreversible	C > F	Prompt worker fatality	$\mathbf{C} > \text{Prompt worker}$		L	III	111	IV	IV
M = Mitigative (reduces event consequences)		other serious effects or acu		acute injury that is	fatality or acute injury that	Ŭ	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		0	1 5 5						
		action.									
	Μ	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						

		permanent disabilities;	permanent disabilities;
		hospitalization required.	hospitalization required.
L	Mild, transient	Minor injuries; no	Minor injuries; no
	adverse effects > C	hospitalization $> C$	hospitalization $> C$
N	Consequences less	Consequences less than	Consequences less than
	than those for Low	those for Low Consequence	those for Low
	Consequence Level	Level	Consequence Level

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

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		I = situation (eve	ent) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (ev	ent) of concern		1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	s	Η	Ι	Ι	Π	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	N = Negligible		vent) of minimal concern		М	II	II	III	IV	
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2		Onsite-1 (facility worker)	equ	T		m	TT Z	TT Z	
P = Preventive (reduce event occurrence likelihood)	H	C > Irreversible	$\mathbf{C} > \mathbf{F}$	Prompt worker fatality	C > Prompt worker	ons	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects	or	acute injury that is	fatality or acute injury that		Ν	IV	IV	IV	IV	
Acronyms		or symptoms which		immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		0	1 5 6							
		action.										
	М	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							

		permanent disabilities;	permanent disabilities;
		hospitalization required.	hospitalization required.
L	Mild, transient	Minor injuries; no	Minor injuries; no
	adverse effects > C	hospitalization $> C$	hospitalization $> C$
N	Consequences less	Consequences less than	Consequences less than
	than those for Low	those for Low Consequence	those for Low
	Consequence Level	Level	Consequence Level

Table 2.15 Thermal Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		I = situation (eve	ent) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (ev	ent) of concern		1	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	es	Η	Ι	Ι	Π	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (e	vent) of minimal concern	enc	М	II	II	III	IV	
Control(s) Type	С	Offsite (MOI) Onsite-2 (co		e-2 (co-located worker)	Onsite-1 (facility worker)	edu				TT Z	T Z	
P = Preventive (reduce event occurrence likelihood)	Н	C > Irreversible	$\mathbf{C} > \mathbf{F}$	Prompt worker fatality	C > Prompt worker		L	III	III	IV	IV	
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or	or acute injury that is			Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	i	immediately life-	is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		2								
		action.										
	Μ	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ Serious injury, no							
		adverse effects.	imm	nediate loss of life no	immediate loss of life no							

		permanent disabilities;	permanent disabilities;
		hospitalization required.	hospitalization required.
L	Mild, transient	Minor injuries; no	Minor injuries; no
	adverse effects > C	hospitalization $> C$	hospitalization $> C$
N	Consequences less	Consequences less than	Consequences less than
	than those for Low	those for Low Consequence	those for Low
	Consequence Level	Level	Consequence Level

Table 2.16 Kinetic Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.															
Likelihood (L, of event)/year	C	onsequence (C, of event))/year	Risk (R, Qualitative	Risk (R, Qualitative Ranking)			Risk Matrix							
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	I = situation (event) of major concern					Like	lihood				
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		$\mathbf{II} = \text{situation}$ (ev	ent) of concern				А	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	event) of minor concern		es l	I	Ι	Ι	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	IV = situation (event) of minimal concern		1 lenc	Л	II	Π	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)		edu			111	TV.	TV /			
P = Preventive (reduce event occurrence likelihood)	Н	H $\mathbf{C} \ge $ Irreversible $\mathbf{C} \ge $ Prot		Prompt worker fatality	C > Prompt worker		ous	-	Ш	111	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects, or a		acute injury that is	fatality or acute injury that			V	IV	IV	IV	IV			

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

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

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.														
Likelihood (L, of event)/year	C	Consequence (C, of event)/year R		Risk (R, Qualitative	, Qualitative Ranking)			Risk Matrix						
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		I = situation (eve	$\mathbf{I} = \text{situation (event) of major concern}$				Likelihood					
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (ev	ent) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (e	vent) of minor concern	es	Η	Ι	Ι	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	IV = situation (event) of minimal concern		М	II	Π	III	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)		T	TTT						
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} >$ Irreversible.	C > F	Prompt worker fatality	$\mathbf{C} > \text{Prompt worker}$	ons	L	III	111	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	other serious effects. $c \ge 110$ mp		fatality or acute injury that	C	Ν	IV	IV	IV	IV			
Acronyms		or symptoms which	i	immediately life-	is immediately life-									

MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or
		individual's ability to	disabling.	permanently disabling.
		take protective		
		action.		
	Μ	$C \ge Mild$, transient	$\mathbf{C} \ge $ Serious injury, no	$\mathbf{C} \ge $ Serious injury, no
		adverse effects.	immediate loss of life no	immediate loss of life no
			permanent disabilities;	permanent disabilities;
			hospitalization required.	hospitalization required.
	L	Mild, transient	Minor injuries; no	Minor injuries; no
		adverse effects > C	hospitalization $> C$	hospitalization > C

Table 2.18 Kinetic Energy – MOI Offsite

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

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	C	onsequence (C, of event)	/year	Risk (R, Qualitative Ranking)		Risk Matrix								
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	n (event) of major concern				Likelihood					
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (ev	ent) of concern			Α	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	ses	Η	Ι	Ι	Π	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	М	II	П	Ш	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edu	т		ш	117	TV.			
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq$ Irreversible.	$\mathbf{C} \ge \mathbf{F}$	Prompt worker fatality	$\mathbf{C} \geq \text{Prompt worker}$	ons	L	111	ш	IV	IV			
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or	acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV			

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

Table 2.19 Potential Energy – Onsite-1 Facility Worker

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

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

Likelihood (L, of event)/year	C	onsequence (C, of event)/2	year	Risk (R, Qualitative	Ranking)	Risk	x Matri	x			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (even	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Н	Ι	Ι	Π	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T			n z	T <i>V</i>
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq$ Irreversible.	$\mathbf{C} > \mathbf{P}$	rompt worker fatality	$\mathbf{C} > \text{Prompt worker}$	suo	L	111	111	IV	IV
M = Mitigative (reduces event consequences)		other serious effects.	or	r acute injury that is fatality or acute injury that			Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	mmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	Μ	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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.						
	L	Mild, transient	Ν	Ainor injuries; no	Minor injuries; no						
		adverse effects $> C$	ho	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 2.20 Potential Energy – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year	Risk (R, Qualitative Ranking)	Dielz Matri	Dick Matrix								
A = Anticipated (L > 1.0E-02)	$\mathbf{H} = \mathrm{High}$	NISK WIAU I	Likalihaad									
U = Unlikely (1.0E-02 > L > 1.0E-04)	$\mathbf{M} = \mathbf{M}$ oderate	$\mathbf{II} = \text{situation (event) of concern}$		А	U	EU	BEU					
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)	$\mathbf{L} = \mathbf{Low}$	III = situation (event) of minor concern	Uсн	T	I	П	Ш					
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$	N = Negligible	IV = situation (event) of minimal concern		1	1	п						

Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	М	II	II	III	IV
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	L N	III IV	III IV	IV IV	IV IV
		action.							
	Μ	$C \ge Mild$, transient	$\mathbf{C} \ge$ Serious injury, no	$C \ge$ Serious injury, no					
		adverse effects.	immediate loss of life no	immediate loss of life no					
			permanent disabilities;	permanent disabilities;					
			hospitalization required.	hospitalization required.					
	L	Mild, transient	Minor injuries; no	Minor injuries; no					
		adverse effects $> C$	hospitalization $> C$	hospitalization $> C$					
	Ν	Consequences less	Consequences less than	Consequences less than					
		than those for Low	those for Low Consequence	those for Low					
		Consequence Level	Level	Consequence Level					

Table 2.21 Potential Energy – MOI Offsite

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

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

Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	x Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		$\mathbf{II} = \text{situation}$ (eve	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Н	Ι	I	Π	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T			TV.	13.7
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} > $ Irreversible.	C > F	Prompt worker fatality	$\mathbf{C} > \text{Prompt worker}$	suo	L	111	ш	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)	1	other serious effects.	or	acute injury that is	Ŭ	Ν	IV	IV	IV	IV	
Acronyms		or symptoms which	j	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	ng or permanently threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		2							
		action.									
	М	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ 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	Ν	Minor injuries; no	Minor injuries; no						
		adverse effects $> C$	h	ospitalization > C	hospitalization > C						
	Ν	Consequences less	Cor	nsequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.22 Magnetic Fields – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cor	ısequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event))/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation (event) of concern}$			1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (event) of minor concern		es	Н	Ι	Ι	Π	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	(event) of minimal concern		М	II	Π	III	IV
Control(s) Type	С	Offsite (MOI) Onsite-		e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т		TTT	TV.	13.7
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq$ Irreversible.	$\mathbf{C} \ge \mathbf{F}$	Prompt worker fatality	$\mathbf{C} \geq \text{Prompt worker}$	ons	L	III	- 111	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-				•	•	
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently threatening or							
		individual's ability to		disabling.	disabling. permanently disabling.						
		take protective		C							
		action.									
	Μ	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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	Ν	Minor injuries; no	Minor injuries; no						
		adverse effects > C	adverse effects $> C$ hos		hospitalization $> C$						
	Ν	Consequences less	Cor	nsequences less than	Consequences less than						
		than those for Low those for I		for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.23 Magnetic Fields – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cor	nsequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event))/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation (event) of concern}$				Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (event) of minor concern		es	Η	Ι	I	Π	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	tuation (event) of minimal concern		М	II	II	III	IV
Control(s) Type	С	Offsite (MOI) Onsite-		e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т		TT	TV.	13.7
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq$ Irreversible.	$\mathbf{C} \ge \mathbf{F}$	rompt worker fatality	$\mathbf{C} \geq \text{Prompt worker}$	ons	L	III	111	IV	IV
\mathbf{M} = Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-					•	
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently threatening or disabling. permanently disabling.							
		individual's ability to									
		take protective		C							
		action.									
	Μ	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ 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	Ν	Minor injuries; no	Minor injuries; no						
		adverse effects > C	adverse effects $> C$ hos		hospitalization > C						
	Ν	Consequences less	Cor	nsequences less than	Consequences less than						
		than those for Low those for I		for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.24 Magnetic Fields – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cor	ısequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/year	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		\mathbf{I} = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		$\mathbf{II} = \text{situation (event) of concern}$				Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	III = situation (event) of minor concern		Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely $(1.0E-06 > L)$		N = Negligible		IV = situation (ev	event) of minimal concern		М	Π	II	III	IV
Control(s) Type	С	Offsite (MOI) Onsite-2		e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	Ŧ				T <i>V</i>
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} >$ Irreversible.	$\mathbf{C} > \mathbf{P}$	Prompt worker fatality	$\mathbf{C} > \text{Prompt worker}$	ons	L	III	111	IV	IV
M = Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently threatening or							
		individual's ability to		disabling.	permanently disabling.						
		take protective		6	1 5 5						
		action.									
	Μ	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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.						
	L	Mild, transient	Ν	Ainor injuries; no	Minor injuries; no						
		adverse effects $> C$	adverse effects $> C$ hos		hospitalization > C						
	Ν	Consequences less	Consequences less Conse		Consequences less than						
		than those for Low	than those for Low those for		those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.25 Other hazards – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cons	sequen	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	'year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		\mathbf{I} = situation (event) of major concern					Likelihood		
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (evolution)	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəş	т	ш	ш	W	TV.
P = Preventive (reduce event occurrence likelihood)	Н	$C \ge Irreversible$,	$\mathbf{C} \ge \mathbf{P}$	rompt worker fatality	$C \ge Prompt worker$	ons	L	m	- 111	1 V	1 V
$\mathbf{M} = $ Mitigative (reduces event consequences)	reduces event consequences) other serious effects, or		or	or acute injury that is fatality or acute injury that		C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-	-					
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	Μ	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
		perm		manent disabilities;	permanent disabilities;						
			hosp	pitalization required.	hospitalization required.						
	L	Mild, transient	Ν	Ainor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization $> C$						

1	N	Consequences less	Consequences less than	Consequences less than	
		than those for Low	those for Low Consequence	those for Low	
		Consequence Level	Level	Consequence Level	

Table 2.26 Other hazards – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (ev	ent) of concern		-	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T	ш	ш	TV.	117
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq $ Irreversible,	$\mathbf{C} \ge \mathbf{F}$	Prompt worker fatality	$C \ge Prompt worker$	suo	L	ш	III	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects. or a		acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		Ũ							
		action.									
	Μ	$C \ge Mild$, transient	C	≥ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						
			peri		permanent disabilities;						
		hospit		pitalization required.	hospitalization required.						
	L	Mild, transient	Ν	Minor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization > C						

1	N	Consequences less	Consequences less than	Consequences less than	
		than those for Low	those for Low Consequence	those for Low	
		Consequence Level	Level	Consequence Level	

Table 2.27 Other hazards – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event).	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
$\mathbf{A} = \text{Anticipated} (\text{L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathrm{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		$\mathbf{II} = \text{situation}$ (ev	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	T	m	ш	W	Π/
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq $ Irreversible,	$\mathbf{C} \ge \mathbf{F}$	Prompt worker fatality	$C \ge Prompt worker$	suo	L	ш	ш	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-	•			•	•	
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		U	1 5 5						
		action.									
	М	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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	N	Minor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization > C						

٦	N	Consequences less	Consequences less than	Consequences less than	
		than those for Low	those for Low Consequence	those for Low	
		Consequence Level	Level	Consequence Level	

Table 2.28 Access & Egress – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	l , "E	xample Qualitative Cons	sequen	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}$ oderate		II = situation (evolution)	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	Π	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edu	×		***		
P = Preventive (reduce event occurrence likelihood)	H	C > Irreversible	$\mathbf{C} > \mathbf{P}$	rompt worker fatality	C > Prompt worker	ons	L	III	- 111	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	С	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	mmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		C							
		action.									
	М	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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.						
	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 2.29 Access & Egress – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	, "E	example Qualitative Cons	sequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
$\mathbf{A} = \text{Anticipated} (L > 1.0\text{E-}02)$		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (even	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	se	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	II	П	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	T				
P = Preventive (reduce event occurrence likelihood)	Н	C > Irreversible	$\mathbf{C} > \mathbf{P}$	Prompt worker fatality	$\mathbf{C} > \text{Prompt worker}$	suo	L	III	111	IV	IV
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects.	or	acute injury that is	fatality or acute injury that	C	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	immediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	tening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		U	1 5 6						
		action.									
	Μ	$C \ge Mild$, transient	C 2	≥ Serious injury, no	$C \ge$ 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	Ν	Minor injuries; no	Minor injuries; no						
		adverse effects $> C$	h	ospitalization > C	hospitalization > C						
	Ν	Consequences less	Cor	nsequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 2.30 Access & Egress – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	1, "E	xample Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year	Risk (R, Qualitative	Ranking)	Risk	Matri	x			
A = Anticipated (L > 1.0E-02)		$\mathbf{H} = \mathrm{High}$		$\mathbf{I} = \text{situation}$ (even	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{M}\mathbf{o}\mathbf{d}\mathbf{e}\mathbf{r}\mathbf{a}\mathbf{t}\mathbf{e}$		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	es	Η	Ι	Ι	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	Π	II	III	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	nbə	т	ш	ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	$\mathbf{C} \geq $ Irreversible,	$\mathbf{C} \ge \mathbf{P}$	rompt worker fatality	$C \ge Prompt worker$	ons	L		III	1 V	1 V
$\mathbf{M} = $ Mitigative (reduces event consequences)		other serious effects,	or	acute injury that is	fatality or acute injury that	0	Ν	IV	IV	IV	IV
Acronyms		or symptoms which	i	mmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threat	ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		6	1 5 6						
		action.									
	Μ	$C \ge Mild$, transient	C ≥	≥ Serious injury, no	$C \ge$ Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
			peri	manent disabilities;	permanent disabilities;						
			hosp	vitalization required.	hospitalization required.						
	L	Mild, transient	Ν	Ainor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization > C						

N	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 2.31 Environmental

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Airborne	 Hazard: Airborne release of radionuclides beyond permitted limits. Discharge of chemicals into onsite surface waters beyond permitted limits. 	L: C: R:	See Section I Chapter 04	L: C: R:
Water	 Hazard: Discharge of radionuclides into onsite surface waters beyond permitted limits. Discharge of chemicals into onsite surface waters beyond permitted limits. 	L: C: R:	See Section I Chapter 04	L: C: R:
Soil	Hazard: • Radioactive soil in beam loss areas beyond allowable concentrations of radionuclides beyond	L: C: R:	See Section I Chapter 04	L: C: R:

	calculated Fermilab			
	limits.			
•	Discharge of chemicals			
	into onsite soils beyond			
	permitted limits.			