Table 12. Summary of Baseline and Residual Risks - NuMI

	Risk Tables Description	Baseline Risk	Residual Risk
12.1	Radiological – Onsite-1 Facility Worker	R: I	R: IV
12.2	Radiological – Onsite-2 Co-located Worker	R: I	R: IV
12.3	Radiological – MOI Offsite	R: I	R: IV
12.4	Toxic Materials – Onsite 1 Facility Worker	R: III	R: IV
12.5	Toxic Materials – Onsite 2 Co-located Worker	R: III	R: IV
12.6	Toxic Materials – MOI Offsite	R: III	R: IV
12.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: *	R: *
12.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *
12.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
12.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *
12.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *
12.12	Electrical Energy – MOI Offsite	R: *	R: *
12.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
12.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
12.15	Thermal Energy – MOI Offsite	R: *	R: *
12.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
12.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
12.18	Kinetic Energy – MOI Offsite	R: *	R: *
12.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
12.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
12.21	Potential Energy – MOI Offsite	R: *	R: *
12.22	Magnetic Fields – Onsite-1 Facility Worker	R: *	R: *
12.23	Magnetic Fields – Onsite-2 Co-located Worker	R: *	R: *
12.24	Magnetic Fields – MOI Offsite	R: *	R: *
12.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
12.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
12.27	Other Hazards – MOI Offsite	R: *	R: *
12.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
12.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
12.30	Access & Egress – MOI Offsite	R: *	R: *
12.31	Environmental Hazards	R: *	R: *

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

NOTE:

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

"Events with an unmitigated risk value of III or IV would not require additional control assignments to provide reasonable assurance of adequate protection. Whereas, for events with an unmitigated risk value of I or II, controls would need to be assigned to either reduce the likelihood or the consequence, and therefore the overall mitigated risk. Generally, preventive controls are applied prior to a loss event – reflecting a likelihood reduction and mitigative controls are applied after a loss event – reflecting a consequence reduction. Each control is credited for a single "bin drop" either in likelihood or consequence; not both. Following a standard hierarchy of controls, controls are applied until the residual risk is acceptable – reflecting a mitigated risk value of III or IV. After controls are credited, events with a remaining unacceptable residual risk (i.e., I or II) are candidates for additional analyses and additional controls, often quantitative in nature." For Fermilab, these controls for accelerator-specific hazards are identified as Credited Controls and further summarized in the Accelerator Safety Envelope (ASE).

Table 12.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Exposure to ionizing radiation beyond regulatory limits.	L: A C: H R: I	 P – General and/or Job Specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P – Use of on LSM: Use of a log survey monitor is specified by a RWP. The LSM allows for real time monitoring of radiation levels during work. P – Radiological Training: An educational system managed by ES&H that establishes basic worker knowledge through presentations and testing. 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. M – Target Pile Shielding: Material placed between radiation sources in the target pile and the enclosure to be protected. This is a passive mitigation. P – As needed: the RCT or RSO will monitor the job as specified by the RWP. 	L: BEU C: L R: IV
Groundwater Activation	Hazard: Radionuclides in ground water exceed regulatory levels	L: A C: H R: I	 P - Active and automatic beam tuning is performed to limit beam losses. P - Monitoring wells are sampled periodically to determine the levels if any detectable in the groundwater. P - Sump pump systems are engineered systems engineered to limit water radioactivation. 	L: BEU C: L R: IV

Hazard Hazard Description Surface Water Hazard: Radionuclides in surface		Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
		L: A	See Section I Chapter 04	L: BEU
Activation	water exceed regulatory levels	C: H		C: L
		R: I		R: IV
Radioactive Water (RAW) Systems	Hazard: Persons are exposed, beyond regulatory levels, to radioactive water	L: A C: H R: I	 P – RAW Key Control System: Multiple key systems prevent personnel access to radioactive water systems. P – Secondary Containment is engineered containment that prevents unintended exposure to contaminated water. P – General and/or Job Specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P – Use Of an LSM: Use of a log survey monitor is specified by a RWP. The LSM allows for real time monitoring of radiation levels during work. M – Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. M – RCT Or RSO Monitoring: A RWP will specify that a Radiation Control Technician or Radiation Safety Officer be present during certain kinds of work or work conditions. The radiological expert can make real time decisions to limit, stop, or prevent radiation 	L: BEU C: L R: IV
Air Activation	Hazard: Radionuclides in air exceed	L: A	exposure to personnel. This is an active mitigation. See Section I Chapter 04	L: EU
	regulatory levels	C: H		C: N
		R: I		R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	itative isk chout trols) Preventative (P)/ Mitigative (M)			
Soil Interactions	Hazard: Radionuclides are produced by beam which may contaminate soil near the decay pipe	L: A C: N R: IV	 P – Active and automatic beam tuning is performed to limit beam losses. M – Beamline Design and Engineered Beam Dump: the beamline is designed that includes measures to reduce unwanted beam particle losses, as well as the use of a beam dump (absorber) design that minimizes radiological leakage through the use of shielding. This is a passive mitigation. M – Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. M – Past studies have characterized the migration of tritium into shielding and lessons have been applied. 	L: U C: N R: IV		
Radioactive Waste	Hazard: Persons are exposed to ionizing radiation beyond regulatory levels	L: A C: L R: III	 P - General and/or Job Specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P - Use Of an LSM: Use of a log survey monitor is specified by a RWP. The LSM allows for real time monitoring of radiation levels during work. 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. 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. 	L: EU C: N R: IV		

Hazard Hazard Description		Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Contamination	Hazard: Persons are exposed to ionizing radiation beyond regulatory levels	L: A C: H R: I	 P - Shielding for Activated Contamination: Shielding material prevents unintended exposure to sources and personnel. P - Radiological Surveying and Cleaning: RCTs and RSOs survey for and clean radiological contamination as part of the RWP process. P - General and/or Job Specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P - Use of an LSM: Use of a log survey monitor is specified by a RWP as necessary. The LSM allows for real time monitoring of radiation levels during work. 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. Active mitigation by containing contaminated items to prevent release is used as necessary 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 	L: BEU C: L R: IV
⁷ Be	Hazard: Potential radiation exposure to ⁷ Be (uptake/committed dose).	L: A C: N R: IV	contamination. This is an active mitigation. No prevention or mitigation is required. ⁷ Be isn't hazardous in this pattern of use by facility.	L: A C: N R: IV

Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative R	Risk (R, Qualitative Ranking)			Risk Matrix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (even)	t) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (eve	(event) of minor concern		Н	I	I	II	III
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		$\mathbf{N} = $ Negligible		IV = situation (event) of minimal concern		ence	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nba	_			***	***
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)	M	25.0 rem > \mathbf{C} ≥ 5 rem	10	00 rem > C ≥ 25 rem	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV
Acronyms	L	5 rem > C		25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 12.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	ctivation radiation beyond regulatory limits.		 P – General and/or job specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P – LSM: Monitors radiation levels during job P – Radiological Training: educates workers about radiological hazards, and general means and methods to reduce exposure. M – Radiological signage and cool off (decay) time requirements prior to entry M – Target pile shielding: attenuates radiation. 	L: BEU C: L R: IV
Groundwater Activation	Hazard: radionuclides in ground water exceed regulatory levels	L: A C: H R: I	See Section I Chapter 04	L: BEU C: L R: IV
Surface Water Activation	Hazard radionuclides in surface water exceed regulatory levels	L: A C: H R: I	See Section I Chapter 04	L: BEU C: L R: IV
Radioactive Water (RAW) Systems	Hazard: persons are exposed, beyond regulatory levels, to radioactive water	L: A C: H R: I	 P - Active and automatic beam tuning is performed to limit beam losses. P - Monitoring wells are sampled periodically to determine the levels if any detectable in the groundwater. P - Sump pump systems are engineered systems engineered to limit water radioactivation. M - Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. 	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Air Activation	Hazard: radionuclides in air exceed	L: A	See Section I Chapter 04	L: EU
	regulatory levels	C: H R: I		C: N R: IV
Soil Interactions	Hazard: radionuclides are produced which may contaminate ground water	L: A C: N R: IV	 P – Active and automatic beam tuning is performed to limit beam losses. M – Beamline Design and Engineered Beam Dump: the beamline is designed that includes measures to reduce unwanted beam particle losses, as well as the use of a beam dump (absorber) design that minimizes radiological leakage through the use of shielding. This is a passive mitigation. M – Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. M – Past studies have characterized the migration of tritium into shielding and lessons have been applied. 	L: U C: N R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Radioactive	Hazard: persons are exposed to	L: A	P – General and/or Job Specific RWP: A Radiological Work Permit is	L: EU
Waste	ionizing radiation beyond regulatory levels	C: L R: III	written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P – Use Of an LSM: Use of a log survey monitor is specified by a RWP. The LSM allows for real time monitoring of radiation levels during work. 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. 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.	C: N R: IV

Hazard	Hazard Hazard Description (c)		Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Contamination	Hazard: persons are exposed to ionizing radiation beyond regulatory levels	L: A C: H R: I	 P - Shielding for Activated Contamination: Shielding material prevents unintended exposure to sources and personnel. P - Radiological Surveying and Cleaning: RCTs and RSOs survey for and clean radiological contamination as part of the RWP process. P - General and/or Job Specific RWP: A Radiological Work Permit is written by ES&H that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure. P - Use Of an LSM: Use of a log survey monitor is specified by a RWP as necessary. The LSM allows for real time monitoring of radiation levels during work. 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. Active mitigation by containing contaminated items to prevent release is used as necessary 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. 	L: BEU C: L R: IV
⁷ Be	Hazard: Potential radiation exposure to 7Be (uptake/committed dose).	L: A C: N R: IV	No prevention or mitigation is required. ⁷ Be isn't hazardous in this pattern of use by facility.	L: A C: N 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 Risk (R, Qualitative Ranking) Risk Matrix											
A = Anticipated (L > 1.0E-02)	Col	$\mathbf{H} = \text{High}$	ycai	I = situation (event) of major concern		KISK	Mau	<u> </u>	Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (event) of concern				A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (even)	on (event) of minor concern		Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N} = $ Negligible		IV = situation (event) of minimal concern		ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nba	_	***		***	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	ous	L	III	III	IV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	S	N	IV	IV	IV	IV
Acronyms	L	5 rem > C	10	25 rem > C	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > C		5 rem > C	5 rem > C						

Table 12.3 Radiological – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: exposure to ionizing radiation beyond regulatory limits.	L: BEU C: H R: III	 P - Access to areas with this hazard are protected by on site access restrictions and restricted access to buildings P - Access to the enclosure is further protected by interlocked keys. These keys are not issued to members of the public. This prevents them from being exposed to residual activation. P - Radiological Signage: Signs located in various places throughout the accelerator complex warn of various hazards and occupancy restrictions. 	L: BEU C: M R: IV
Groundwater Activation	Hazard: radionuclides in ground water exceed regulatory levels	L: A C: H R: I	See Section I Chapter 04	L: EU C:M R: III
Surface Water Activation	Hazard: radionuclides in surface water exceed regulatory levels	L: A C: H R: I	See Section I Chapter 04	L: BEU C: M R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	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	 P - RAW Key Control System: Multiple key systems prevent personnel access to radioactive water systems. P - Secondary Containment is engineered containment that prevents unintended exposure to contaminated water. M - Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. M - RCT Or RSO Monitoring: A RWP will specify that a Radiation Control Technician or Radiation Safety Officer 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. 	L: BEU C: M R: IV
Air Activation	Hazard: radionuclides in air exceed regulatory levels	L: BEU C: H R: III	See Section I Chapter 04	L: BEU C: M R: IV
Soil Interactions	Hazard: radionuclides are produced which may contaminate ground water	L: BEU C: H R: III	 P – Active and automatic beam tuning is performed to limit beam losses. M – Beamline Design and Engineered Beam Dump: the beamline is designed that includes measures to reduce unwanted beam particle losses, as well as the use of a beam dump (absorber) design that minimizes radiological leakage through the use of shielding. This is a passive mitigation. M – Run Conditions: Operating parameters that reduce activation by limiting the total amount of beam that can be delivered are specified. Specifically, this includes an operating limit for protons/hr. This is an active mitigation and the systems that must be operational for running beam are spelled out. M – Past studies have characterized the migration of tritium into shielding and lessons have been applied. 	L: BEU C: M R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Radioactive	Hazard: persons are exposed to	L: BEU	P – Access to areas with this hazard are protected by on site access	L: BEU
Waste	ionizing radiation beyond regulatory	C: H	restrictions and restricted access to buildings.	C: M
	levels	R: III	 P - Radiological Signage: Signs located in various places throughout the accelerator complex warn of various hazards and occupancy restrictions. 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. 	R: IV
Contamination	Hazard: persons are exposed to	L: BEU	P – Access to areas with this hazard are protected by on site access	L: BEU
	ionizing radiation beyond regulatory	C: H	restrictions and restricted access to buildings.	C: M
	levels	R: III	 P - Radiological Signage: Signs located in various places throughout the accelerator complex warn of various hazards and occupancy restrictions. P - Shielding for Activated Contamination: Shielding material prevents unintended exposure to sources and personnel. 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. Active mitigation by containing contaminated items to prevent release is used as necessary. 	R: IV
⁷ Be	Hazard: Potential radiation exposure	L: A	No prevention or mitigation is required. ⁷ Be isn't hazardous in this pattern	L: A
	to 7Be (uptake/committed dose).	C: N	of use by facility.	C: N
		R: IV		R: IV

Radiological Hazard Consequences, derived from Figu	adiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	Cor	sequence (C, of event)/	year /	Risk (R, Qualitative R	anking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event)	t) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever)	nt) of concern			Α	U	EU	BEU
$\mathbf{EU} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$		L = Low		III = situation (eve	ent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (eve	ent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	aba	_	***	***	TV 7	***
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		C ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV
$\mathbf{M} = \mathbf{M}$ itigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	ပ	N	IV	IV	IV	IV
Acronyms MOI - Maximally, avposed Offsite Individual	L	5 rem > C		25 rem > C	25 rem > C	Ī					
rem = Roentgen equivalent man	OI = Maximally-exposed Offsite Individual n = Roentgen equivalent man DI = Maximally-exposed Offsite Individual N			5 rem > C 5 rem > C							

Table 12.4 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Beryllium	Hazard: Beryllium beam windows	L: U	P – Windows designed to be contained by consumable and replaceable	L: EU
	may rupture and fragment.	C: L	components rather than released into the target hall.	C: N
		R: III	M – Engineered designs assure appropriate pressure differential across	R: IV
			particle windows.	

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative	Risk Matrix								
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern			Likelihood					
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI) Onsite-		e-2 (co-located worker)	Onsite-1 (facility worker)	edn		777	777	13.7	IV		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Cons	L	III	III	IV	IV		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms	T.	PAC-1 > C		$\frac{PAC-2 > C}{PAC-2 > C}$	PEL or TLV _c > \mathbf{C}								
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV _c = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level								

Table 12.5 Toxic Materials – Onsite 2 Co-located Worker

Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hazard: Beryllium beam windows	L: U	P – Windows designed to be contained by consumable and replaceable	L:EU
may rupture and fragment.	C: L	components rather than released into the target hall.	C: N
	R: III	M – Engineered designs assure appropriate pressure differential across	R: IV
	Hazard: Beryllium beam windows	Hazard Description Risk (without controls) Hazard: Beryllium beam windows may rupture and fragment. L: U C: L	Hazard Description Qualitative Risk (without controls) Preventative (P)/ Mitigative (M)

	Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.													
Co	onsequence (C, of event)	/year	Risk (R, Qualitative Ranking)			Risk Matrix								
	$\mathbf{H} = \mathbf{High}$		I = situation (even)	nt) of major concern			Likelihood							
	$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (evolution } \mathbf{II}$	ent) of concern			A	U	EU	BEU				
	$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III				
	N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV				
C	Offsite (MOI) Onsite-		e-2 (co-located worker)	Onsite-1 (facility worker)	edn		TTT	TTT	TX 7	IV				
Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	111	Ш	1V	IV				
M	PAC-2 > C > PAC-1	P.A	AC-3 > C > PAC-2	$IDLH > C > PEL \text{ or } TLV_c$	С	N	IV	IV	IV	IV				
T.														
N	Consequences less than those for Low Consequence Level		nsequences less than	Consequences less than those for Low Consequence Level										
	C H M L	H = High $M = Moderate$ $L = Low$ $N = Negligible$ C	$ \begin{aligned} \mathbf{M} &= \mathbf{Moderate} \\ \mathbf{L} &= \mathbf{Low} \\ \mathbf{N} &= \mathbf{Negligible} \end{aligned} $ $ \begin{aligned} \mathbf{C} & \mathbf{Offsite} \; (\mathbf{MOI}) & \mathbf{Onsite} \\ \mathbf{H} & \mathbf{C} \geq \mathbf{PAC-2} \\ \mathbf{M} & \mathbf{PAC-2} > \mathbf{C} \geq \mathbf{PAC-1} & \mathbf{PAC} \\ \mathbf{L} & \mathbf{PAC-1} > \mathbf{C} \\ \mathbf{N} & \mathbf{Consequences} \; \mathbf{less} \\ \mathbf{than} \; \mathbf{those} \; \mathbf{for} \; \mathbf{Low} & \mathbf{those} \end{aligned} $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				

Table 12.6 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Beryllium	Hazard: Potential exposure to beryllium dust during manual handling of un-encased, or machining dusts from fabrication shop activities.	L: BEU C:H R:III	P – The NuMI Area is beyond the public access gates P – Components are in beamline, thus inaccessible to public.	L: BEU C: H R: III

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 Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern		1	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (e	vent) of minor concern	ses	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	T	III	Ш	IV	IV		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Suo,	L	111	111	1 V	1 V		
M = Mitigative (reduces event consequences)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms IDI II — Immediately Dengarous to Life and Health	L	PAC-1 > C		PAC-2 > C	PEL or $TLV_c > C$								
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level								
TLV_c = Threshold Limit Value (ceiling)													

Table 12.7 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 (cables,		C:		C:
Boxes, Paper,		R:		R:
wood cribbing,				
etc.)				

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	Ranking)	Risk	Matri	X				
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern	l	1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (evaluation)	vent) of minor concern	se	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sednences		***	***	77.7	77.7	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > P	rompt worker fatality	C ≥ Prompt worker	ous	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV	
Acronyms		or symptoms which		mmediately life-	is immediately life-			•		•		
MOI = Maximally-exposed Offsite Individual		could impair an		ening or permanently	threatening or							
		individual's ability to	disabling.		permanently disabling.							
		take protective		C								
		action.										
	M	$C \ge Mild$, transient	C ≥	≥ Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	imm	ediate loss of life no	immediate loss of life no							
			per	manent disabilities;	permanent disabilities;							
			hosp	oitalization required.	hospitalization required.							
	L	Mild, transient	N	Minor injuries; no	Minor injuries; no							
		adverse effects > C	h	ospitalization > C	hospitalization $> \mathbf{C}$							
	N	Consequences less	Cor	sequences less than	Consequences less than							
		than those for Low	those	for Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 12.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	sequen	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02) U = Unlikely (1.0E-02> L > 1.0E-04) EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L) Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	C H	onsequence (C, of event)/ H = High M = Moderate L = Low N = Negligible Offsite (MOI) C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective	Onsite $C \ge P$ or i	II = situation (ev III = situation (ev	nt) of major concern	Consequences	H M L N	A I III III IV	Like U I II III IV	EU II III IV IV	BEU III IV IV IV
	M L N	action. C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C Consequences less	imm per hosp N ho	≥ Serious injury, no nediate loss of life no rmanent disabilities; pitalization required. Minor injuries; no ospitalization > C nsequences less than for Low Consequence Level	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low Consequence Level						

Table 12.9 Flammable and Combustible Materials – MOI Offsite

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

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 A = Anticipated (L > 1.0E-02) U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L) Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	C H	onsequence (C, of event)/ H = High M = Moderate L = Low N = Negligible Offsite (MOI) C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to	Onsite $C \ge P$ or i	II = situation (ev III = situation (ev	ent) of major concern	Risk	H M L N	A I III III IV	Like U I II III IV	EU II III IV IV	BEU III IV IV
	M L N	take protective action. C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C Consequences less	imm per hosp N ho	≥ Serious injury, no nediate loss of life no manent disabilities; pitalization required. Minor injuries; no ospitalization > C neequences less than for Low Consequence	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C Consequences less than those for Low Consequence Level						

Table 12.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		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, Qualita	ative l	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation	I = situation (event) of major concern					Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situatio	n (eve	ent) of concern		ı	Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situation	on (ev	vent) of minor concern	ses	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible	IV = situation	on (ev	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located work	er)	Onsite-1 (facility worker)	Consequences		***	***	77.7	***		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fata	lity	C ≥ Prompt worker	suo	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	-	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	-	is immediately life-					•			
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permaner	ntly	threatening or								
		individual's ability to	disabling.		permanently disabling.								
		take protective	C		, ,								
		action.											
	M	C ≥ Mild, transient	C ≥ Serious injury, no	О	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life	no	immediate loss of life no								
			permanent disabilities	s;	permanent disabilities;								
			hospitalization require	ed.	hospitalization required.								
	L	Mild, transient	Minor injuries; no		Minor injuries; no								
		adverse effects > C	hospitalization > C		hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less that	an	Consequences less than								
		than those for Low	those for Low Conseque	ence	those for Low								
		Consequence Level	Level		Consequence Level								

Table 12.11 Electrical Energy 1 Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		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	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms				nmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual					threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		_							
		action.									
	M	C ≥ Mild, transient	C ≥	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imme	ediate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			hospi	italization required.	hospitalization required.						
	L	Mild, transient	M	linor injuries; no	Minor injuries; no						
		adverse effects > C	ho	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 12.12 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,		L:	See Section I Chapter 04	L:
High Current		C:		C:
Exposure.		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	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (e	vent) of minor concern	uces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7
	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)	0 = 1110 / 0151010, 0 = 11			cute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms				nmediately life-	· · ·						
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently threatening or							
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	M	$C \ge Mild$, transient	C ≥ 3	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imme	ediate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			hospit	italization required.	hospitalization required.						
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no						
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 12.13 Thermal Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	/year l	Risk (R, Qualitative	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	elihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (even}$	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	Ш	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	Consequences		TTT	***	77.7	TY 7	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > Pro	ompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV	
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV	
Acronyms		or symptoms which		mediately life-	is immediately life-	-						
MOI = Maximally-exposed Offsite Individual				ning or permanently	threatening or							
		individual's ability to		disabling.	permanently disabling.							
		take protective		· ·								
		action.										
	M	C ≥ Mild, transient	C ≥ S	Serious injury, no	C ≥ Serious injury, no							
		adverse effects.	immed	diate loss of life no	immediate loss of life no							
			perma	anent disabilities;	permanent disabilities;							
			hospit	talization required.	hospitalization required.							
	L	Mild, transient	Mi	nor injuries; no	Minor injuries; no							
		adverse effects $> \mathbf{C}$ hosp		spitalization > C	hospitalization $> \mathbf{C}$							
	Ν	Consequences less Consequences		equences less than	Consequences less than							
		than those for Low	those fo	or Low Consequence	those for Low							
		Consequence Level		Level	Consequence Level							

Table 12.14 Thermal Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work		L: 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						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (eve}$	ent) of major concern				Likelihood						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern		1	A	U	EU	BEU				
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (ex	vent) of minor concern	nces	Н	I	I	II	III				
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV				
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***		** *					
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suo	L	III	III	IV	IV				
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	S	N	IV	IV	IV	IV				
Acronyms		or symptoms which	immediately life-	is immediately life-										
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or										
		individual's ability to	disabling.	permanently disabling.										
		take protective	Č											
		action.												
	M	$C \ge Mild$, transient	$C \ge Serious injury, no$	C ≥ Serious injury, no										
		adverse effects.	immediate loss of life no	immediate loss of life no										
			permanent disabilities;	permanent disabilities;										
			hospitalization required.	hospitalization required.										
	L	Mild, transient	Minor injuries; no	Minor injuries; no										
		adverse effects $> \mathbf{C}$	hospitalization $> \mathbf{C}$	hospitalization $> \mathbf{C}$										
	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 12.15 Thermal Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	/year]	Risk (R, Qualitative	Ranking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	Consequences		TTT	***	***	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality or acute injury that is immediately life- threatening or permanently		C ≥ Prompt worker	suo	L	III	III	IV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,			fatality or acute injury that is immediately life-	C	N	IV	IV	IV	IV
Acronyms		or symptoms which				-			•	•	
MOI = Maximally-exposed Offsite Individual					threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		C							
		action.									
	M	C ≥ Mild, transient	C ≥ S	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immed	diate 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	hos	spitalization > C	hospitalization $> \mathbf{C}$						
	Ν	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 12.16 Kinetic Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.											
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High	I = situation (eve	Risk (R, Qualitative Ranking) I = situation (event) of major concern			ix	DEII			
$\mathbf{U} = \text{Unlikely } (1.0\text{E}-02 > \text{L} > 1.0\text{E}-04)$ $\mathbf{E}\mathbf{U} = \text{Extremely Unlikely } (1.0\text{E}-04 > \text{L} > 1.0\text{E}-06)$ $\mathbf{B}\mathbf{E}\mathbf{U} = \text{Beyond Extremely Unlikely } (1.0\text{E}-06 > \text{L})$		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	sednences	Н	I II	I I	EU II	BEU III IV	
Control(s) Type P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual	C H	Offsite (MOI) $C \ge Irreversible$,	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker) $C \ge \text{Prompt worker}$	Conseque	L	III	III	IV IV	IV IV	
		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life-threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		N	14	ıv	17	14	
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.							
	L	Mild, transient adverse effects $> \mathbf{C}$	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C							
	N	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level	Consequences less than those for Low Consequence Level							

Table 12.17 Kinetic Energy – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	1, "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 Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	L	III	III	IV	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 action.	or i	Prompt worker fatality acute injury that is immediately life-tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no rmanent disabilities; pitalization required. Minor injuries; no ospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C						

Table 12.18 Kinetic Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	l, "F	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			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	seou	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	T	III	III	IV	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 action.	or i	Prompt worker fatality acute injury that is immediately life- tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Cons	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects. Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no manent disabilities; pitalization required. Minor injuries; no ospitalization > C	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. Minor injuries; no hospitalization > C						

Table 12.19 Potential Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which		nmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imme	ediate loss of life no	immediate loss of life no						
			pern	nanent disabilities;	permanent disabilities;						
			hospi	italization required.	hospitalization required.						
	L	Mild, transient	M	linor injuries; no	Minor injuries; no						
		adverse effects > C	ho	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those for	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 12.20 Potential Energy – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern		ı	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7		
	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which		nmediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ening or permanently	threatening or								
		individual's ability to		disabling.	permanently disabling.								
		take protective		-									
		action.											
	M	$C \ge Mild$, transient	C ≥ 3	Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	imme	ediate loss of life no	immediate loss of life no								
			perm	nanent disabilities;	permanent disabilities;								
			hospit	italization required.	hospitalization required.								
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no								
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Cons	sequences less than	Consequences less than								
		than those for Low	those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 12.21 Potential Energy – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	***	***	77.7	77.7
	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which		nmediately life-	is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imme	ediate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			hospi	italization required.	hospitalization required.						
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no						
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 12.22 Magnetic Fields – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	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, Q	ualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situ	iation (eve	ent) of major concern				lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \mathbf{sit}$	uation (ev	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	$\mathbf{III} = \mathbf{s}$	ituation (e	vent) of minor concern	ses	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = si	ituation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located	worker)	Onsite-1 (facility worker)	Consequences	_	***	***	***	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worke	r fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury	-	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately l		is immediately life-					•	
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or perr		threatening or						
		individual's ability to	disabling.	-	permanently disabling.						
		take protective	C								
		action.									
	M	C ≥ Mild, transient	C ≥ Serious inju	ıry, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of	f life no	immediate loss of life no						
			permanent disab	ilities;	permanent disabilities;						
			hospitalization re	quired.	hospitalization required.						
	L	Mild, transient	Minor injuries	s; no	Minor injuries; no						
		adverse effects > C	hospitalization	> C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences le	ss than	Consequences less than						
		than those for Low	those for Low Con	sequence	those for Low						
		Consequence Level	Level		Consequence Level						

Table 12.23 Magnetic Fields – Onsite-2 Co-located Worker

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

Likelihood (L, of event)/year	C	onsequence (C, of event)/	year Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		ent) of major concern			Likelihood					
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	-	vent) of minor concern	Sea	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ences	М	II	П	III	IV		
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nba							
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt$ worker fatality	C ≥ Prompt worker	use	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)	-	other serious effects,	or acute injury that is	fatality or acute injury that	CO	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-		1						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	uisae iiig.	permanently disusting.								
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization $> C$	hospitalization $> \mathbf{C}$								
	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 12.24 Magnetic Fields – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	sequence Matrix", DOE	-HDI	BK-1163-2020.								
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year Risk (R, Qualita	tive l	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation	(ever	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	II = situation	n (eve	ent) of concern		ı	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situation	on (ev	vent) of minor concern	ses	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situatio	n (ev	vent) of minimal concern	enc	M	II	II	Ш	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located work	er)	Onsite-1 (facility worker)	Consequences	_	777	***	77.7	***		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatal	lity	C ≥ Prompt worker	suo	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	-	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-		is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permanen	ıtly	threatening or								
		individual's ability to	disabling.		permanently disabling.								
		take protective	C										
		action.											
	M	C ≥ Mild, transient	C ≥ Serious injury, no)	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life r	10	immediate loss of life no								
			permanent disabilities	;	permanent disabilities;								
			hospitalization required	d.	hospitalization required.								
	L	Mild, transient	Minor injuries; no		Minor injuries; no								
		adverse effects > C	hospitalization > C		hospitalization > C								
	Ν	Consequences less	Consequences less that	n	Consequences less than								
		than those for Low	those for Low Conseque	nce	those for Low								
		Consequence Level	Level		Consequence Level								

Table 12.25 Other hazards – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	e Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{H} = situation (evo	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	***	***	77.7	77.7		
	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV		
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV		
Acronyms		or symptoms which		nmediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently	threatening or								
		individual's ability to		disabling.	permanently disabling.								
		take protective		-									
		action.											
	M	$C \ge Mild$, transient	C ≥ 3	Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immed	diate 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	hos	spitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Conse	equences less than	Consequences less than								
		than those for Low	those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

Table 12.26 Other hazards – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	e Matrix", DOE-HD	BK-1163-2020.									
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood					
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		\mathbf{H} = situation (evo	ent) of concern			A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	***	***	77.7	77.7			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV			
M = Mitigative (reduces event consequences)		other serious effects,		cute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV			
Acronyms		or symptoms which		nmediately life-	is immediately life-									
MOI = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently	threatening or									
		individual's ability to		disabling.	permanently disabling.									
		take protective		-										
		action.												
	M	$C \ge Mild$, transient	C ≥ 3	Serious injury, no	C ≥ Serious injury, no									
		adverse effects.	immed	diate 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	hos	spitalization > C	hospitalization $> \mathbf{C}$									
	N	Consequences less	Conse	equences less than	Consequences less than									
		than those for Low	those fo	or Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

Table 12.27 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: C:	See Section I Chapter 04	L: C:
		R:		R:
Noise	Hazard:	L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics	Hazard:	L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.									
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood					
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (evolution)	ent) of concern			A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III			
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	***	777	77.7	77.7			
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	compt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV			
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV			
Acronyms		or symptoms which		nmediately life-	is immediately life-									
MOI = Maximally-exposed Offsite Individual		could impair an	threate	ening or permanently	threatening or									
		individual's ability to		disabling.	permanently disabling.									
		take protective		-										
		action.												
	M	$C \ge Mild$, transient	C ≥	Serious injury, no	C ≥ Serious injury, no									
		adverse effects.	imme	ediate loss of life no	immediate loss of life no									
			perm	nanent disabilities;	permanent disabilities;									
			hospi	italization required.	hospitalization required.									
	L	Mild, transient	M	linor injuries; no	Minor injuries; no									
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$									
	N	Consequences less	Cons	sequences less than	Consequences less than									
		than those for Low	those fo	or Low Consequence	those for Low									
		Consequence Level		Level	Consequence Level									

Table 12.28 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		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-	l, "E	Example Qualitative Cons	sequen	ice Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year /	Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (ever	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	es	Н	I	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces	_	***	***	77.7	77.7
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C > P	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)		other serious effects,		acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which		mmediately life-	is immediately life-			•	•	•	
MOI = Maximally-exposed Offsite Individual		could impair an		ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		C							
		action.									
	M	C ≥ Mild, transient	C ≥	≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			hosp	oitalization required.	hospitalization required.						
	L	Mild, transient	N	Minor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	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 12.29 Access & Egress – Onsite-2 Co-located Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	rear Risk (R, Qualitative	Ranking)	Risk	Matri	X					
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (even}$	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (even}$	ent) of concern		ı	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situation (evolution)	vent) of minor concern	ses	Н	I	I	II	III		
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev)	vent) of minimal concern	enc	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	,	777	TTT	13.7	13.7		
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,	or acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
MOI = Maximally-exposed Offsite Individual		• •	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective	_									
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no								
		adverse effects.	immediate loss of life no	immediate loss of life no								
			permanent disabilities;	permanent disabilities;								
			hospitalization required.	hospitalization required.								
	L	Mild, transient	Minor injuries; no	Minor injuries; no								
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less than	Consequences less than								
		than those for Low	hose for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

Table 12.30 Access & Egress – MOI Offsite

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Co	onsequence (C, of event)/year Risk (R, Qualita			Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation	I = situation (event) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation}$	on (eve	ent) of concern			A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	III = situati	ion (ev	vent) of minor concern	səx	Н	I	I	II	III	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situati	ion (ev	vent) of minimal concern	enc	M	II	II	Ш	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worl	ker)	Onsite-1 (facility worker)	Consequences		***	***	77.7	***	
P = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fata	ality	C ≥ Prompt worker	Suo L		III	III	IV	IV	
M = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is		fatality or acute injury that	C	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-		is immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or permane	ently	threatening or							
		individual's ability to	disabling.		permanently disabling.							
		take protective	C		1 2							
		action.										
	M	C ≥ Mild, transient	C ≥ Serious injury, r	10	C ≥ Serious injury, no							
		adverse effects.	immediate loss of life	no	immediate loss of life no							
			permanent disabilitie	es;	permanent disabilities;							
			hospitalization require	ed.	hospitalization required.							
	L	Mild, transient	Minor injuries; no		Minor injuries; no							
		adverse effects > C	hospitalization > C	,	hospitalization $> \mathbf{C}$							
	N	Consequences less	Consequences less th	an	Consequences less than							
		than those for Low	those for Low Consequ	ence	those for Low							
		Consequence Level	Level		Consequence Level							

Table 12.31 Environmental

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