Table 9. Summary of Baseline and Residual Risks-8 GeV Line

	Risk Tables Description	Baseline Risk	Residual Risk
9.1	Radiological – Onsite-1 Facility Worker	R: I	R: IV
9.2	Radiological – Onsite-2 Co-located Worker	R: I	R: IV
9.3	Radiological – MOI Offsite	R:NA	R:NA
9.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
9.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
9.6	Toxic Materials – MOI Offsite	R: *	R: *
9.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: NA*	R: NA*
9.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: *	R: *
9.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
9.10	Electrical Energy – Onsite-1 Facility Worker	R: *	R: *
9.11	Electrical Energy – Onsite-2 Co-located Worker	R: *	R: *
9.12	Electrical Energy – MOI Offsite	R: NA*	R: NA*
9.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
9.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
9.15	Thermal Energy – MOI Offsite	R: NA*	R: NA*
9.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
9.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
9.18	Kinetic Energy – MOI Offsite	R: NA*	R: NA*
9.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
9.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
9.21	Potential Energy – MOI Offsite	R: NA*	R: NA*
9.22	Magnetic Fields – Onsite-1 Facility Worker	R: *	R: *
9.23	Magnetic Fields – Onsite-2 Co-located Worker	R: *	R: *
9.24	Magnetic Fields – MOI Offsite	R: NA*	R: NA*
9.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
9.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
9.27	Other Hazards – MOI Offsite	R: NA*	R: NA*
9.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
9.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
9.30	Access & Egress – MOI Offsite	R: NA*	R: NA*
9.31	Environmental Hazards	R: *	R: *

<sup>\*</sup> 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~9.1~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 residual activation	L: A C: H R: I	<ul> <li>P - Locked Gates: Barriers to entrances of areas that contain radioactive material. Keys are required to open these gates.</li> <li>P - Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>P - Radiological Work Permit: A permit written by Safety that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P - Postings: Signs located in various places throughout the accelerator warning of various hazards and occupancy restrictions.</li> <li>P - Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>P - Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M - Local Component Shielding: Material placed between the local component and the area to be protected. The material is used to attenuate the radiation flux by a factor related to the radiation length of the material.</li> <li>M - Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> </ul>	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Groundwater	Hazard: Radionuclides in ground	L: A	P – Monitoring Wells: Wells that are drilled near accelerator enclosures in	L: EU
Activation	water exceed regulatory levels	C: H	areas that are sensitive to potential aquifer contamination. These	C: M
		R: I	wells are periodically sampled and analyzed by ES&H to ensure the aquifer is not becoming contaminated from accelerator operations.  P – Sump Pumps: Pumps located in the accelerator enclosure that have an underdrain network. The water is pumped to the surface, so it does not stagnate in the accelerator and becomes activated.  P – Beam loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.  M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water	Hazard: Radionuclides in surface	L: A	P – Sump Pumps: Pumps located in the accelerator enclosure that have an	L: BEU
Activation	water exceed regulatory levels	C: H R: I	underdrain network. The water is pumped to the surface, so it does not stagnate in the accelerator and becomes activated prior to removing the water from the enclosure.  P – Sump Monitoring Program; Sump water samples are periodically collected and measured for radiological activation. If activation is found in the sump sample, we have the ability to look for the root cause before additional water is pumped to the surface.  P – Beam Loss Monitoring Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.  M – Machine Protection System: An accelerator system that monitors devices such as beam loss monitors, power supplies, vacuum valves, etc. If these devices are not within their specified limits, the beam is aborted and further injections into the accelerator are inhibited until the system is reset by an operator.  M – Pond Monitoring Program: Samples taken from the ponds and measured for activation. Sump water from the tunnel is discharged into these ponds.  M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.	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 regulatory levels	L: A C: H R: I	<ul> <li>P – Air Monitoring: Air sampled from the enclosure for activation</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> <li>P – Beam loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Engineered Air Flow: Enclosure air flow design to give the activated air time to decay before exiting the enclosure.</li> </ul>	L: EU C: L R: IV
Soil Interactions	Hazard: Radionuclides are produced which may contaminate ground water	L: A C: H R: I	<ul> <li>P – Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Engineered Beam Dump: Design of a beam absorber that minimizes the radiological leakage through the used of shielding.</li> <li>M – Beamline Design: Design of beamline optics to ensure that the actual beam size is smaller than the beam pipe to prevent scraping, beam loss, prompt dose, and residual activation.</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered</li> </ul>	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 – Locked Gates: Barriers to entrances of areas that contain radioactive	L: BEU
Waste	ionizing radiation beyond regulatory	C: H	material. Keys are required to open these gates.	C: L
	levels	R: I	<ul> <li>P – Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>P – Postings: Signs located in various places throughout the accelerator warning of various hazards and occupancy restrictions</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> <li>M – Distance to Stored Material: Barriers, such as ropes, that are used to increase the distance between the activated material and personnel.</li> </ul>	R: IV
Contamination	Hazard: Persons are exposed to	L: A	P – Locked Gates: Barriers to entrances of areas that contain radioactive	L:EU
	ionizing radiation beyond regulatory	C: H	material. Keys are required to open these gates.	C: L
	levels	R: I	<ul> <li>P – Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>M – Radiological Work Permit: A permit written by Safety that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>M – Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> </ul>	R: IV
<sup>7</sup> Be	Hazard: Potential radiation exposure	L: A	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't	L: A
	to <sup>7</sup> Be (uptake/committed dose)	C: N	hazardous in this pattern of use by facility.	C: N
		R: IV		R: IV

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	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (even	t) of major concern				Like	lihood	_
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (even}$	nt) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (eve	ent) of minor concern	es	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible		<b>IV</b> = situation (eve	ent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsi	te-2 (co-located worker)	Onsite-1 (facility worker)	edn		TTT	777	TX 7	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	<b>C</b> ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem	ons	L	III	III	IV	IV
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	00 rem > <b>C</b> ≥ 25 rem	100 rem > C ≥ 25 rem		N	IV	IV	IV	IV
Acronyms  MOI – Maximally, averaged Offsite Individual	L	5 rem > <b>C</b>		25 rem > <b>C</b>	25 rem > C						
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > C						

Table 9.2 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	Hazard: Exposure to residual activation	L: A C: H R: I	<ul> <li>P - Locked Gates: Barriers to entrances of areas that contain radioactive material. Keys are required to open these gates.</li> <li>P - Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>P - Radiological Work Permit: A permit written by Safety that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>P - Postings: Signs located in various places throughout the accelerator warning of various hazards and occupancy restrictions.</li> <li>P - Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> <li>P - Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss into electrical signals. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated with adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M - Local Component Shielding: Material placed between the local component and the area to be protected. The material is used to attenuate the radiation flux by a factor related to the radiation length of the material.</li> <li>M - Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> </ul>	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Groundwater	Hazard: Radionuclides in ground	L: A	P – Monitoring Wells: Wells that are drilled near accelerator enclosures in	L: BEU
Activation	water exceed regulatory levels	C: H	areas that are sensitive to potential aquifer contamination. These	C: L
		R: I	<ul> <li>wells are periodically sampled and analyzed by ES&amp;H to ensure the aquifer is not becoming contaminated from accelerator operations.</li> <li>P – Sump Pumps: Pumps located in the accelerator enclosure that have an underdrain network. The water is pumped to the surface, so it does not stagnate in the accelerator and becomes activated.</li> <li>P – Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated whit adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Machine Protection System: An accelerator system that monitors devices such as beam loss monitors, power supplies, vacuum valves, etc. If these devices are not within their specified limits, the beam is aborted and further injections into the accelerator are inhibited until the system is reset by an operator.</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> </ul>	R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Surface Water Activation	Hazard: Radionuclides in surface water exceed regulatory levels	L: A C: H R: I	<ul> <li>P – Sump Pumps: Pumps located in the accelerator enclosure that have an underdrain network. The water is pumped to the surface, so it does not stagnate in the accelerator and becomes activated prior to removing the water from the enclosure.</li> <li>P – Sump Monitoring Program; Sump water samples are periodically collected and measured for radiological activation. If activation is found in the sump sample, we have the ability to look for the root cause before additional water is pumped to the surface.</li> <li>P – Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated whit adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Pond Monitoring program: Samples taken from the ponds and measured for activation. Sump water from the tunnel is discharged into these ponds.</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> </ul>	L: EU C: M R: IV
Air Activation	Hazard: Radionuclides in air exceed regulatory levels	L: A C: H R: I	<ul> <li>P – Air Monitoring: Air sampled from the enclosure for activation</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> <li>P – Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits.</li> <li>Losses can be reduced or eliminated whit adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Engineered Air Flow: Enclosure air flow design to give the activated air time to decay before exiting the enclosure.</li> </ul>	L: BEU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Soil Interactions	Hazard: Radionuclides are produced which may contaminate ground water	L: A C: H R: I	<ul> <li>P – Beam Loss Monitoring: Electronic Beam Loss Monitors are used to convert radiation created by prompt dose due to beam loss. This information is then made available to the accelerator control system where the data can be logged and monitored with alarms and limits. Losses can be reduced or eliminated whit adjustment to the accelerators to prevent activation of tunnel components.</li> <li>M – Engineered Beam Dump: Design of a beam absorber that minimizes the radiological leakage through the used of shielding.</li> <li>M – Beamline Design: Design of beamline optics to ensure that the actual beam size is smaller than the beam pipe to prevent scraping, beam loss, prompt dose, and residual activation.</li> <li>M – Run conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered</li> </ul>	L: EU C: L R: IV
Radioactive Waste	Hazard: Persons are exposed to ionizing radiation beyond regulatory levels	L: A C: H R: I	<ul> <li>P – Locked Gates: Barriers to entrances of areas that contain radioactive material. Keys are required to open these gates.</li> <li>P – Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>P – Postings: Signs located in various places throughout the accelerator warning of various hazards and occupancy restrictions</li> <li>M – Run Conditions: Operating parameters that reduce residual activation by limiting the total amount of beam that could be delivered.</li> <li>M – Distance to Stored Material: Barriers, such as ropes, that are used to increase the distance between the activated material and personnel.</li> </ul>	L: U 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	<ul> <li>P – Locked Gates: Barriers to entrances of areas that contain radioactive material. Keys are required to open these gates.</li> <li>P – Key Control Program: A program that checks the worker's training prior to issuing them a key to the accelerator enclosure. Also keeps track of worker accountability.</li> <li>M – Radiological Work Permit: A permit written by Safety that specifies the work that is permitted to be performed, requirements to perform the work, and limitations of radiological exposure.</li> <li>M – Training: An educational system managed by ES&amp;H that establishes basic worker knowledge through presentations and testing.</li> </ul>	L: BEU C: L R: IV
<sup>7</sup> Be	Hazard: Potential radiation exposure to <sup>7</sup> Be (uptake/committed dose)	L: A C: N R: IV	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this pattern of use by facility.	L:EU C: L R: IV 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	Cor	onsequence (C, of event)/year   Risk (R, Qualitative Ranking)   R						Risk Matrix				
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (even	t) of major concern							
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = situation (even	nt) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		<b>III</b> = situation (eve	ent) of minor concern	sə	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N} = \text{Negligible}$		<b>IV</b> = 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)	nbəs	,	777	***	77.7	***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	<b>C</b> ≥ 25.0 rem		<b>C</b> ≥ 100 rem	C ≥ 100 rem	Suo	L	III	III	IV	IV	
M = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	00 rem > <b>C</b> ≥ 25 rem	100 rem > <b>C</b> ≥ 25 rem		N	IV	IV	IV	IV	
Acronyms  MOI - Maximally, averaged Offsite Individual	L	5 rem > <b>C</b>		25 rem > C	25 rem > <b>C</b>							
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem > <b>C</b>	5 rem > C							

**Table 9.3 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 residual activation	L: BEU C: N R: IV	Not Applicable. No prevention or mitigation is required. The area is located beyond the public access gate.	L: BEU C: N R: IV
Groundwater Activation	Hazard: Radionuclides in ground water exceed regulatory levels	L: C: R:	See Section I Chapter 04.	L: C: R:
Surface Water Activation	Hazard: Radionuclides in surface water exceed regulatory levels	L: C: R:	See Section I Chapter 04.	L: C: R:
Air Activation	Hazard: Radionuclides in air exceed regulatory levels	L: BEU C: N R: IV	Not Applicable. No prevention or mitigation is required. The area is located beyond the public access gate.	L: BEU C: N R: IV
Soil Interactions	Hazard: Radionuclides are produced which may contaminate ground water	L: BEU C: N R: IV	Not Applicable. No prevention or mitigation is required. The area is located beyond the public access gate.	L: BEU C: N R: IV
Radioactive Waste	Hazard: Persons are exposed to ionizing radiation beyond regulatory levels	L: BEU C: N R: IV	Not Applicable. No prevention or mitigation is required. The area is located beyond the public access gate.	L: BEU C: N R: IV

Hazard	(without controls)  Hazard: Persons are exposed to ionizing radiation beyond regulatory levels  Hazard: Potential radiation exposure  L: BEU C: N R: IV  Not Applicable. No prevention or mitigation is required. The area is located beyond the public access gate.  Hazard: Potential radiation exposure  L: A  Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't					
Contamination	ionizing radiation beyond regulatory	C: N		L: BEU C: N R: IV		
<sup>7</sup> Be	Hazard: Potential radiation exposure to <sup>7</sup> Be (uptake/committed dose)	L: A C: N R: I	Not Applicable. No prevention or mitigation is required. <sup>7</sup> Be isn't hazardous in this pattern of use by facility.	L: A C: N R: IV		

Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Cor	nsequence (C, of event)/	year	Risk (R, Qualitative R	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (even	t) of major concern				Likelihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = situation (even	nt) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		<b>III</b> = situation (eve	ent) of minor concern	s	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N} = $ Negligible		<b>IV</b> = situation (event) 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)	llaba		***	***	***	***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	C ≥ 100 rem	ons	L	III	III	IV	IV	
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	00 rem > C ≥ 25 rem	100 rem > C ≥ 25 rem	C	N	IV	IV	IV	IV	
Acronyms  MOI - Movimelly, avenued Officia Individual	L	5 rem > <b>C</b>		25 rem > <b>C</b>	25 rem > <b>C</b>							
MOI = Maximally-exposed Offsite Individual rem = Roentgen equivalent man	N	0.5 rem > <b>C</b>		5 rem > <b>C</b>	5 rem > <b>C</b>							

**Table 9.4 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: Potential exposure to lead dust during manual handling of un- encased lead bricks, lead shot, and lead sheets	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	Co	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							
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		<b>III</b> = situation (ev	vent) of minor concern	seo	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	$\mathbf{N} = $ Negligible		vent) of minimal concern	e e	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	т .	III	III	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ PAC-2		<b>C</b> ≥ PAC-3	C ≥ IDLH	ons	L	111	Ш	1 V	1 V	
<b>M</b> = Mitigative (reduces event consequences)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV	
Acronyms  IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > <b>C</b>		PAC-2 > C	PEL or TLV <sub>c</sub> > C							
MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV <sub>c</sub> = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level							

**Table 9.5 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 Shielding	Hazard: Potential exposure to lead dust during manual handling of un- encased lead bricks, lead shot, and lead sheets	L: A C: H R: I	See Section I Chapter 04.	L: BEU C: L R: IV

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)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = situation (ev	ent) of concern	l .		A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (e	vent) of minor concern	sea	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	т .	III	Ш	IV	IV	
	Н	C ≥ PAC-2		<b>C</b> ≥ PAC-3	C ≥ IDLH	ons	L	111	Ш	1 V	10	
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	PAC-2 > <b>C</b> ≥ PAC-1	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV	
Acronyms	L	PAC-1 > <b>C</b>		PAC-2 > <b>C</b>	PEL or $TLV_c > C$							
<b>IDLH</b> = Immediately Dangerous to Life and Health	N	Consequences less	Cor	nsequences less than	Consequences less than							
<b>MOI</b> = Maximally-exposed Offsite Individual	1	than those for Low		for Low Consequence	those for Low							
<b>PAC</b> = Protective Action Criteria			uiose	•	***************************************							
<b>PEL</b> = Permissible Exposure Limit		Consequence Level		Level	Consequence Level							
$TLV_c$ = Threshold Limit Value (ceiling)												

**Table 9.6 Toxic Materials – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Lead Shielding	Hazard: Potential exposure to lead	L:	See Section I Chapter 04.	L:
	dust during manual handling of un-	C:		C:
	encased lead bricks, lead shot, and	R:		R:
	lead sheets			

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	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern							
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = situation (ev	ent) of concern	_		Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		<b>III</b> = situation (e	vent) of minor concern	es	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	N = Negligible		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	, T	TIT	Ш	IV	IV	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Cons	L	III	Ш	1 V	1 V	
<b>M</b> = Mitigative (reduces event consequences)	M	PAC-2 > <b>C</b> ≥ PAC-1	P.A	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$	С	N	IV	IV	IV	IV	
Acronyms	L	PAC-1 > <b>C</b>		PAC-2 > <b>C</b>	PEL or TLV <sub>c</sub> > $\mathbf{C}$							
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV <sub>c</sub> = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		nsequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level							

 ${\bf Table~9.7~Flammable~and~Combustible~Materials-Onsite~-1~Facility~Worker}$ 

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

Other Hazard Consequences, derived from Figure C-1	l, "F	Example Qualitative Cons	equence 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)		$\mathbf{H} = \mathbf{High}$	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			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	$\mathbf{III} = \text{situation (e}$	vent) of minor concern	sə	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (evolution)	vent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedne	_	TTT	TIT	17.7	13.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,	or acute injury that is	fatality or acute injury that	၂၂၁	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	C							
		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 9.8 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.)				
Flammable		L:	See Section I Chapter 04.	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\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	uces	Н	I	I	II	III
<b>BEU</b> = 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 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	TTT	777	13.7	TS 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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	immediately life- threatening or permanently		is immediately life-			•		•	<u> </u>
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	$C \ge Mild$ , transient	<b>C</b> ≥	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 9.9 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.)				
Flammable		L:	See Section I Chapter 04.	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1	, "F	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\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	uces	Н	I	I	II	III
<b>BEU</b> = 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 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	***	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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	immediately life- threatening or permanently		is immediately life-			•	•	•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	<b>C</b> ≥	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	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those f	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.10 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	, "F	xample Qualitative Cons	sequence	e Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		<b>I</b> = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = 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	nces	Н	I	I	II	III
<b>BEU</b> = 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	(co-located worker)	Onsite-1 (facility worker)	sedu		***	777	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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	immediately life- threatening or permanently		is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		_							
		action.									
	M	$C \ge Mild$ , transient	$C \ge S$	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	alization required.	hospitalization required.						
	L	Mild, transient	Mi	nor injuries; no	Minor injuries; no						
		adverse effects > C	hos	pitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those for	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

 Table 9.11 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	, "F	Example Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (evaluation	vent) of minor concern	uces	Н	I	I	II	III
<b>BEU</b> = 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
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Pr$	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	٥	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life- threatening or permanently		is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		_							
		action.									
	M	$C \ge Mild$ , transient	<b>C</b> ≥	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 > 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 9.12 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	, "F	Example Qualitative Cons	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year											
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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	uces	Н	I	I	II	III
<b>BEU</b> = 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 (co-located worker)	Onsite-1 (facility worker)	nbəs	_	***	***	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)				acute injury that is	fatality or acute injury that	٥	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life- threatening or permanently		is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		_							
		action.									
	M	$C \ge Mild$ , transient	<b>C</b> ≥	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;						
			hosp	italization required.	hospitalization required.						
	L	Mild, transient	M	Iinor injuries; no	Minor injuries; no						
		adverse effects > C	ho	ospitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those f	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.13 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	C	onsequence (C, of event)/y	ear Risk (R, Qualitative	Risk (R, Qualitative Ranking)			Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	<b>I</b> = situation (event) of major concern									
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)		$\mathbf{L} = \mathbf{Low}$	III = situation (evaluation	vent) of minor concern	ses	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06>L)$		N = Negligible	IV = situation (evolution)	ent) 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	111	13.7	TX 7			
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV			
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV			
Acronyms		or symptoms which	immediately life-	is immediately life-									
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or									
		individual's ability to	disabling.	permanently disabling.									
		take protective											
		action.											
	M	$C \ge Mild$ , 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									
			hose for Low Consequence	those for Low									
		Consequence Level	Level	Consequence Level									

**Table 9.14 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	Ranking)	Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (eve}$	<b>I</b> = situation (event) 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		T	Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$	<b>III</b> = situation (ex	vent) of minor concern	nces	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	- E	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbə	_	***		***	***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suo	L	III	III	IV	IV	
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	ŭ	N	IV	IV	IV	IV	
Acronyms		or symptoms which	immediately life-	is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or							
		individual's ability to	disabling.	permanently disabling.							
		take protective	Č								
		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 $> \mathbf{C}$	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 9.15 Thermal Energy – MOI Offsite** 

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	ear Risk (R, Qualitative	ar   Risk (R, Qualitative Ranking)			Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	<b>I</b> = situation (event) of major concern								
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (even}$	ent) of concern		1	A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (evolution)	vent) of minor concern	ses	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	enc	M	II	II	Ш	IV		
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	,	777	111	13.7	TX 7		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV		
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV		
Acronyms		or symptoms which	immediately life-	is immediately life-								
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or								
		individual's ability to	disabling.	permanently disabling.								
		take protective										
		action.										
	M	$C \ge Mild$ , 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								
			hose for Low Consequence	those for Low								
		Consequence Level	Level	Consequence Level								

Table 9.16 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:	See Section I Chapter 04.	L:
		C: R:		C: 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:
Mobile Shielding		L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-	1, "F	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year A = Anticipated (L > 1.0E-02)	C	onsequence (C, of event)/y H = High		Ranking) ent) of major concern	Risk	Matri	ix	Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$		vent) of minor concern	ses	Н	A	U	EU II	BEU
BEU = Beyond Extremely Unlikely (1.0E-06> L)  Control(s) Type	C	N = Negligible  Offsite (MOI)	IV = situation (ev Onsite-2 (co-located worker)	vent) of minimal concern Onsite-1 (facility worker)	sednences	M L	III	III	III IV	IV IV
P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	H	$C \ge$ Irreversible, other serious effects,	$C \ge Prompt$ worker fatality or acute injury that is	C ≥ Prompt worker fatality or acute injury that	Con	N	IV	IV	IV	IV
Acronyms  MOI = Maximally-exposed Offsite Individual		or symptoms which could impair an individual's ability to take protective action.	is immediately life- threatening or permanently disabling.							
	M	$C \ge Mild$ , 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 9.17 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:
Mobile Shielding		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)	Ranking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern						
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		<b>III</b> = situation (ev	vent) of minor concern	seou	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	ī	Ш	III	IV	IV
<ul> <li>P = Preventive (reduce event occurrence likelihood)</li> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>	H	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 lifetening 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 9.18 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: R:	See Section I Chapter 04.	L: C: R:
Pumps and Motors		L: C: R:	See Section I Chapter 04.	L: C: R:
Motion Tables		L: C: R:	See Section I Chapter 04.	L: C: R:
Mobile Shielding		L: C: R:	See Section I Chapter 04.	L: C: R:

Other Hazard Consequences, derived from Figure C-1	l, "F	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event).	Ranking)	Risk	Matri	X					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern						
U = Unlikely (1.0E-02 > L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (ev	vent) of minor concern	seou	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern		M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	Ι.	III	III	IV	IV
<ul> <li>P = Preventive (reduce event occurrence likelihood)</li> <li>M = Mitigative (reduces event consequences)</li> <li>Acronyms</li> <li>MOI = Maximally-exposed Offsite Individual</li> </ul>	Н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	Prompt worker fatality acute injury that is immediately lifetening 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 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 9.19 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		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/		L:	See Section I Chapter 04.	L:
Pressure Vessels		C:		C:
		R:		R:
Vacuum Dumma		L:	See Section I Chapter 04.	L:
Vacuum Pumps		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	sequence	Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year R	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (even	tion (event) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II}$ = situation (even	vent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (	(co-located worker)	Onsite-1 (facility worker)	sedu		***	777	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pron	mpt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,		ute injury that is	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which		nediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threateni	ing or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		_							
		action.									
	M	$C \ge Mild$ , transient	C≥Se	erious injury, no	C ≥ Serious injury, no						
		adverse effects.	immedi	iate loss of life no	immediate loss of life no						
			permar	nent disabilities;	permanent disabilities;						
			hospital	alization required.	hospitalization required.						
	L	Mild, transient	Mine	or injuries; no	Minor injuries; no						
		adverse effects > C	hospi	oitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Conseq	quences less than	Consequences less than						
		than those for Low	those for	Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.20 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: C: R:	See Section I Chapter 04.	L: C: R:
Compressed Gasses		L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum/ Pressure Vessels		L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum Pumps		L: C: R:	See Section I Chapter 04.	L: C: R:
Material Handling		L: C: R:	See Section I Chapter 04.	L: C: 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			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$			cuation (event) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = \text{situation (ev}$	vent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (evaluation	vent) of minor concern	uces	Н	I	I	II	III
<b>BEU</b> = 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 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	777	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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		nmediately life-	is immediately life-			•		•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	<b>C</b> ≥	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						

 ${\bf Table~9.21~Potential~Energy-MOI~Offsite}$ 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Crane Operations		L: C: R:	See Section I Chapter 04.	L: C: R:
Compressed Gasses		L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum/ Pressure Vessels		L: C: R:	See Section I Chapter 04.	L: C: R:
Vacuum Pumps		L: C: R:	See Section I Chapter 04.	L: C: R:
Material Handling		L: C: R:	See Section I Chapter 04.	L: C: 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			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ation (event) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	vent) 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
<b>BEU</b> = 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	2 (co-located worker)	Onsite-1 (facility worker)	sedu		***	***	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	compt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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-						
<b>MOI</b> = 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	<b>C</b> ≥	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 9.22 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	l, "E	xample Qualitative Cons	sequence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year   Risk (R, Qualitative	Ranking)	Risk	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		ı	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	<b>III</b> = situation (e	vent) of minor concern	se	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	$IV = situation (e^{-1})$	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences		TTT	111	13.7	TS 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suo	L	III	III	IV	IV
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	ا ا	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-	,					
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	M	$C \ge Mild$ , transient	C ≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects > C	hospitalization > C	hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

**Table 9.23 Magnetic Fields – Onsite-2 Co-located Worker** 

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Cons	sequence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	year   Risk (R, Qualitative	Ranking)	Risk	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		ı	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	<b>III</b> = situation (e	vent) of minor concern	se	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	$IV = situation (e^{-1})$	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences		TTT	111	13.7	TS 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suo	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	ا ا	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-	,					
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	M	$C \ge Mild$ , transient	C ≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects > C	hospitalization > C	hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

**Table 9.24 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	l, "E	Example Qualitative Cons	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/y	rear Risk (R, Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (even}$	nt) of major concern				Like	lihood	
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
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev)	vent) of minimal concern	enc	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	,	777	TTT	13.7	13.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		* *	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	<u> </u>							
		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 t	hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 9.25 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:
Silica		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	l, "F	Example Qualitative Cons	equence 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)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	vent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	sə	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ex	vent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedne	_	TTT	TIT	17.7	13.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	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	၁	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-					•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	C							
		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 9.26 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: R:		C: R:
				+_
Silica		L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:
Ergonomics		L:	See Section I Chapter 04.	L:
		C:		C:
		R:		R:

Other Hazard Consequences, derived from Figure C-1	l, "F	Example Qualitative Cons	equence 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)		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	vent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (e	vent) of minor concern	sə	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ex	vent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedne	_	TTT	TIT	17.7	13.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	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	၂၂၁	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-					•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective	C							
		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 9.27 Other hazards – MOI Offsite** 

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:
Silica		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	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			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$		III = situation (ev	vent) of minor concern	uces	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{N}$ = Negligible		IV = situation (ev	vent) of minimal concern	- E	M	П	II	III	IV
Control(s) Type	C	Offsite (MOI)	Offsite (MOI) Onsite-2 (co-		Onsite-1 (facility worker)	nbəs	_	TTT	TIT	13.7	TX /
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pr	rompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV
<b>M</b> = 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		nmediately life-	is immediately life-			•	•	•	
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an		ening or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		· ·							
		action.									
	M	C ≥ Mild, transient	<b>C</b> ≥	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 9.28 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-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.										
Likelihood (L, of event)/year	C	onsequence (C, of event)/y	ear Risk (R, Qualitative	Risk (R, Qualitative Ranking)		Risk Matrix				
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) 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		1	A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \mathbf{Low}$	III = situation (evolution)	vent) of minor concern	Consequences	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (evolution)	vent) of minimal concern		M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	edn	,	777	111	13.7	TX 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which immediately life-		is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or permanently disabling.						
		individual's ability to	disabling.							
		take protective								
		action.								
	M	$C \ge Mild$ , 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						
			hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 9.29 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:	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,	Risk (R, Qualitative Ranking)		Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = s	I = situation (event) of major concern				Likelihood			
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} =$	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	Consequences	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV =	situation (ev	vent) of minimal concern		M	II	II	Ш	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-locat	ed worker)	Onsite-1 (facility worker)	edn	_	***	***	77.7	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt wor	ker fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injur	-	fatality or acute injury that	C	N	IV	IV	IV	IV
Acronyms		or symptoms which immediately life-		is immediately life-							
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an threatening or pe		•	threatening or						
		individual's ability to disabling.		•	permanently disabling.						
				C							
		action.									
	M	C ≥ Mild, transient	C ≥ Serious in	njury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss	of life no	immediate loss of life no						
			permanent dis	abilities;	permanent disabilities;						
	hosi		hospitalization	required.	hospitalization required.						
	L	Mild, transient	Minor injur	ies; no	Minor injuries; no						
		adverse effects > C	hospitalizati	on > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences	less than	Consequences less than						
		than those for Low	those for Low C	onsequence	those for Low						
		Consequence Level	Level		Consequence Level						

**Table 9.30 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	C	onsequence (C, of event)/y	vear Risk (R, Qualitative	Risk (R, Qualitative Ranking)		Risk Matrix				
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	I = situation (event) 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)		$\mathbf{L} = \mathbf{Low}$	<b>III</b> = situation (ex	vent) of minor concern	Consequences	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern		M	II	II	Ш	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	edn	,	777	111	13.7	TX 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Suo	L	III	III	IV	IV
$\mathbf{M} = \mathbf{Mitigative}$ (reduces event consequences)		other serious effects,	or acute injury that is	fatality or acute injury that		N	IV	IV	IV	IV
Acronyms		or symptoms which immediately life-		is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or						
		individual's ability to	disabling.	permanently disabling.						
		take protective								
		action.								
	M	$C \ge Mild$ , 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						
adver		adverse effects > C	hospitalization > C	hospitalization > C						
	N	Consequences less	Consequences less than	Consequences less than						
			hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

**Table 9.31 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  Discharge of chemicals into onsite surface waters beyond permitted limits	L: C: R:	See Section I Chapter 04.	L: C: R:
Water	Hazards: 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	Hazards: Radioactive soil in beam loss areas beyond allowable concentrations of radionuclides beyond calculated Fermilab limits  Discharge of chemicals into onsite soils beyond permitted limits	L: C: R:	See Section I Chapter 04.	L: C: R: