Table 5. Summary of Baseline and Residual Risks - Linac

	Risk Tables Description	Baseline Risk	Residual Risk
5.1	Radiological – Onsite-1 Facility Worker	R: I	R: IV
5.2	Radiological – Onsite-2 Co-located Worker	R: I	R: IV
5.3	Radiological – MOI Offsite	R: I	R: IV
5.4	Toxic Materials – Onsite 1 Facility Worker	R: *	R: *
5.5	Toxic Materials – Onsite 2 Co-located Worker	R: *	R: *
5.6	Toxic Materials – MOI Offsite	R: *	R: *
5.7	Flammable & Combustible Materials – Onsite-1 Facility Worker	R: I, *	R: IV, *
5.8	Flammable & Combustible Materials – Onsite-2 Co-located worker	R: I, *	R: IV, *
5.9	Flammable & Combustible Materials – MOI Offsite	R: *	R: *
5.10	Electrical Energy – Onsite-1 Facility Worker	R: I, *	R: IV, *
5.11	Electrical Energy – Onsite-2 Co-located Worker	R: I, *	R: IV, *
5.12	Electrical Energy – MOI Offsite	R: *	R: *
5.13	Thermal Energy – Onsite-1 Facility Worker	R: *	R: *
5.14	Thermal Energy – Onsite-2 Co-located Worker	R: *	R: *
5.15	Thermal Energy – MOI Offsite	R: *	R: *
5.16	Kinetic Energy – Onsite-1 Facility Worker	R: *	R: *
5.17	Kinetic Energy – Onsite-2 Co-located Worker	R: *	R: *
5.18	Kinetic Energy – MOI Offsite	R: *	R: *
5.19	Potential Energy- Onsite-1 Facility Worker	R: *	R: *
5.20	Potential Energy – Onsite-2 Co-located Worker	R: *	R: *
5.21	Potential Energy – MOI Offsite	R: *	R: *
5.22	Magnetic Fields – Onsite-1 Facility Worker	R: I	R: III
5.23	Magnetic Fields – Onsite-2 Co-located Worker	R: I	R: III
5.24	Magnetic Fields – MOI Offsite	R: N/A	R: N/A
5.25	Other Hazards – Onsite-1 Facility Worker	R: *	R: *
5.26	Other Hazards – Onsite-2 Co-located Worker	R: *	R: *
5.27	Other Hazards – MOI Offsite	R: *	R: *
5.28	Access & Egress – Onsite-1 Facility Worker	R: *	R: *
5.29	Access & Egress – Onsite-2 Co-located Worker	R: *	R: *
5.30	Access & Egress – MOI Offsite	R: *	R: *
5.31	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).

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Table 5.1 Radiological – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: A C: H R: I	P – Employee Rad Worker training P – ALARA plan M – Shielding to reduce activation M – Proper dosimetry	L: EU C: L R: IV
Air Activation	Hazard: radionuclides in air exceed regulatory levels	L: A C: H R: I	P – Air Monitoring P – Radiation Safety Interlock System P – Beam loss Monitoring M – Engineered air flow to dilute activated air and provide cool off (decay) time prior to release. Enclosure air flow design to give the activated air time to decay before exiting the enclosure. M – Run Conditions	L: BEU C: L R: IV
Radioactive Waste	Hazard: Radiation exposure	L: A C: H R: I	P – Postings P – Beam tuned to reduce beam loss to reduce generation of waste M – Shielding to reduce generation of waste M – Material survey and release process	L: EU C: L R: IV
Contamination	Hazard: Personnel exposure	L: A C: H R: I	<ul> <li>P – Radiological controls personnel survey and decontamination</li> <li>P – Postings place in the event contamination is identified</li> <li>M – Shielding to reduce activation</li> <li>M – Proper PPE specified in RWP</li> </ul>	L: EU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Non-ionizing Radiation – Laser	Hazards: Exposure to Class 3B and 4 lasers	L: A C: H R: I	P – Class 1 (light tight) enclosures P – ORC and work planning processes P – Locked/Interlocked system P – LOTO procedure or other procedure approved by the LSO P – Affected areas are posted M – Use of PPE	L: BEU C: M R: IV
	Exposure to Class 3R lasers	L: A C: L R: III	No analysis required	L: A C: L R: III
	Exposure to Class 1 and 2 Lasers	L: A C: N R: IV	No analysis required	L: A C: N R: IV
Non-ionizing Radiation – RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P – RF Shielding P – ES&H periodic monitoring P – LOTO procedure P – Affected area postings	L: BEU C: M R: IV

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 (event				Like	lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever)	= situation (event) of concern				U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (eve	ent) of minor concern	ences	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		<b>IV</b> = situation (event) of minimal concern			M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nbəs				** *	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem		L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	Co	N	IV	IV	IV	IV
Bold = Credited Control	L	5 rem > <b>C</b>		25 rem > <b>C</b>	25 rem > C						
Acronyms  MOI = Maximally-exposed Offsite Individual	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > C						
<b>rem</b> = Roentgen equivalent man											

Table 5.2 Radiological – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: A C: H R: I	P – Employee Rad Worker training P – ALARA plan M – Shielding to reduce activation M – Proper dosimetry	L: EU C: L R: IV
Air Activation	Hazard: radionuclides in air exceed regulatory levels	L: A C: H R: I	P – Air Monitoring P – Radiation Safety Interlock System P – Beam loss Monitoring M – Engineered air flow to dilute activated air and provide cool off (decay) time prior to release. Enclosure air flow design to give the activated air time to decay before exiting the enclosure. M – Run Conditions	L: BEU C: L R: IV
Radioactive Waste	Hazard: Radiation exposure	L: A C: H R: I	P – Postings P – Beam tuned to reduce beam loss M – Shielding to reduce generation of waste M – Material survey and release process	L: EU C: L R: IV
Contamination	Hazard: Radiation exposure	L: A C: H R: I	P – Radiological controls personnel survey and decontamination P – Postings place in the event contamination is identified M – Shielding to reduce activation M – Proper PPE specified in RWP	L: EU C: L R: IV

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Non-ionizing Radiation – Laser	Hazards: Exposure to Class 3B and 4 lasers	L: A C: H R: I	P – Class 1 (light tight) enclosures P – ORC and work planning processes P – Locked/Interlocked system P – LOTO procedure or other procedure approved by the LSO P – Affected areas are posted M – Use of PPE	L: BEU C: M R: IV
	Exposure to Class 3R lasers	L: A C: L R: III	No analysis required	L: A C: L R: III
	Exposure to Class 1 and 2 Lasers	L: A C: N R: IV	No analysis required	L: A C: N R: IV
Non-ionizing Radiation – RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P - RF Shielding P - ES&H periodic monitoring P - LOTO procedure performed by facility worker P - Affected area postings	L: BEU C: M R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event)/y	year	Risk (R, Qualitative R	anking)	Risk Matrix							
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$	$\mathbf{H} = \mathbf{High}$			I = situation (event				Like	lihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (ever)	situation (event) of concern				U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (eve	ent) of minor concern	ences	Н	I	I	II	III		
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		<b>IV</b> = situation (event) of minimal concern			M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsit	te-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***	***	***	***		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 100 rem		L	III	III	IV	IV		
<b>M</b> = Mitigative (reduces event consequences)	M	$25.0 \text{ rem} > \mathbf{C} \ge 5 \text{ rem}$	10	$00 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	$100 \text{ rem} > \mathbf{C} \ge 25 \text{ rem}$	CO	N	IV	IV	IV	IV		
Bold = Credited Control	L	5 rem > <b>C</b>		25 rem > C	25 rem > C								
Acronyms  MOI = Maximally-exposed Offsite Individual	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > <b>C</b>								
rem = Roentgen equivalent man													

**Table 5.3 Radiological – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/Mitigative (M) Bold are Credited Controls	Residual Qualitative Risk (with controls)
Residual Activation	Hazard: Radiation exposure	L: BEU C: H R: III	No analysis required	L: BEU C: H R: III
Air Activation	Hazard: radionuclides in air exceed regulatory levels	L: BEU C: N R: IV	<ul> <li>P – Facility is locked and not accessible to the unescorted public.</li> <li>P – Interlock system preventing access to beam enclosure while beam is present.</li> <li>P – Enclosure keys linked to radiological and controlled access training to enter enclosure</li> </ul>	L: BEU C: N R: IV
Radioactive Waste	Hazard: Radiation exposure	L: BEU C: H R: III	No analysis required	L: BEU C: H R: III
Contamination	Hazard: Radiation exposure	L: BEU C: N R: IV	No analysis required	L: BEU C: N R: IV
Non-ionizing Radiation – RF	Hazard: Exposure from RF energy above allowed limits	L: A C: M R: II	P - RF Shielding P - ES&H periodic monitoring P - Affected area postings	L: BEU C: M R: IV

Likelihood (L, of event)/year	Cor	sequence (C, of event)/y	ear	Risk (R, Qualitative R	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$				<ul><li>I = situation (event) of major concern</li><li>II = situation (event) of concern</li></ul>					Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)								Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		<b>III</b> = situation (eve	<b>III</b> = situation (event) of minor concern				I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)	$\mathbf{N} = \mathbf{N} = \mathbf{N} = \mathbf{N} = \mathbf{N}$			<b>IV</b> = situation (eve	enc	M	II	II	III	IV	
Control(s) Type	C	Offsite (MOI)	Onsi	ite-2 (co-located worker)	Onsite-1 (facility worker)	edn	-	TTT	***	***	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ 25.0 rem		<b>C</b> ≥ 100 rem	<b>C</b> ≥ 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 > <b>C</b> ≥ 25 rem	100 rem > <b>C</b> ≥ 25 rem		N	IV	IV	IV	IV
Bold = Credited Control	L	5 rem > <b>C</b>		25 rem > <b>C</b>	25 rem > <b>C</b>						
Acronyms  MOI = Maximally-exposed Offsite Individual	N	0.5 rem > <b>C</b>		5 rem > C	5 rem > C						
rem = Roentgen equivalent man											

**Table 5.4 Toxic Materials – Onsite 1 Facility Worker** 

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

Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
C	onsequence (C, of event)	)/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
	$\mathbf{H} = \mathbf{High}$		I = situation (event) of major concern					Like	lihood			
	$\mathbf{M} = \mathbf{Moderate}$		II = situation (ev	ent) of concern			A	U	EU	BEU		
	L = Low		<b>III</b> = situation (e	vent) of minor concern	es	Н	I	I	II	III		
	N = Negligible		<b>IV</b> = situation (ev	vent) of minimal concern	enc	M	II	II	III	IV		
C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	,	TIT	TIT	13.7	IV		
Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	ons	L	111	Ш	1 V	1 V		
M	PAC-2 > <b>C</b> ≥ PAC-1	P.A	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
L	PAC-1 > <b>C</b>		PAC-2 > <b>C</b>	PEL or $TLV_c > C$								
N	Consequences less than those for Low Consequence Level		*	Consequences less than those for Low Consequence Level								
	C	Consequence (C, of event $H = High$ $M = Moderate$ $L = Low$ $N = Negligible$ $C                                    $	Consequence (C, of event)/year $H = High$ $M = Moderate$ $L = Low$ $N = Negligible$ C Offsite (MOI) Onsite $H  C \ge PAC-2$ $M  PAC-2 > C \ge PAC-1$ $PAC-1 > C$ $N  Consequences less  Contain those for Low those$				$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		

**Table 5.5 Toxic Materials – Onsite 2 Co-located Worker** 

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

Chemical Hazard Consequences, derived from Figure	C-1	, "Example Qualitative	Conseq	quence 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)		$\mathbf{M} = \mathbf{Moderate}$		<b>II</b> = situation (even	ent) 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 (ev	vent) 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 (ev	vent) of minimal concern	ences	M	II	II	III	IV		
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedne	т	TIT	ш	IV	IV		
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Cons	L	III	III	1 V	1 V		
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$	M	$PAC-2 > C \ge PAC-1$	PA	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV		
Acronyms	T.	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			mose	•									
<b>PEL</b> = Permissible Exposure Limit		Consequence Level		Level	Consequence Level								
TLV <sub>c</sub> = Threshold Limit Value (ceiling)													

**Table 5.6 Toxic Materials – MOI Offsite** 

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

Chemical Hazard Consequences, derived from Figure	C-1	, "Example Qualitative	Conseq	quence Matrix", DOE-	HDBK-1163-2020.						
Likelihood (L, of event)/year	/year Consequence (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)		$\mathbf{M} = \mathbf{Moderate}$		<b>II</b> = situation (ev	ent) of concern	_		Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = 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		<b>IV</b> = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedno	1	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ PAC-2		C ≥ PAC-3	C ≥ IDLH	Suo	L	111	Ш	1 V	
M = Mitigative (reduces event consequences)	M	$PAC-2 > C \ge PAC-1$	P/	$AC-3 > C \ge PAC-2$	$IDLH > C \ge PEL \text{ or } TLV_c$		N	IV	IV	IV	IV
Acronyms  IDLH = Immediately Dangerous to Life and Health	L	PAC-1 > <b>C</b>		PAC-2 > <b>C</b>	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						

 ${\bf Table~5.7~Flammable~and~Combustible~Materials-Onsite~-1~Facility~Worker}$ 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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	Hazard: H2 leaking, igniting, and	L: A	P – Biannual leak inspections	L: U
Materials	causing a fire.	C: H	M – Hydrogen leak detectors	C: N
(Flammable gas,		R: I	M – Fire department response	R: IV
cleaning			M – Evacuation training/evacuation drills	
materials, etc.)				
	Other flammable materials	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	I = situation (eve	ent) of major concern	Risk	Matri		lihood	DEII	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	sednences	Н	I II	I I	EU II	BEU III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	$C \ge Irreversible,$	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequ	L	III	III	IV IV	IV IV
Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		1				
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects $> \mathbf{C}$	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 5.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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	Hazards: H2 leaking, igniting, and	L: A	P – Biannual leak inspections	L: U
Materials	causing a fire.	C: H	M – Hydrogen leak detectors	C: N
(Flammable gas,		R: I	M – Fire department response	R: IV
cleaning			M – Evacuation training/evacuation drills	
materials, etc.)				
	Other flammable materials		See Section I Chapter 04	L:
		L:		C:
		C:		R
		R		

Other Hazard Consequences, derived from Figure C-1	, "F	xample Qualitative Cons	sequenc	ce Matrix", DOE-HD	BK-1163-2020.								
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix					
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (evolution)	ent) of concern			A	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III		
<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)	sedn	_	***	777	77.7	77.7		
	Н	C ≥ Irreversible,	C ≥ Pro	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	adverse effects $> \mathbf{C}$ hosp		hospitalization $> \mathbf{C}$								
	N	Consequences less	Consequences less Conseq		Consequences less than								
		than those for Low	those fo	or Low Consequence	those for Low								
		Consequence Level		Level	Consequence Level								

**Table 5.9 Flammable and Combustible Materials – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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	Hazards:H2 leak igniting and	L: A	P – Biannual leak inspections	L: U
Materials	causing a fire	C: H	M – Hydrogen leak detectors	C: L
(Flammable gas,		R: I	M – Fire department response	R: III
cleaning				
materials, etc.)				
	Hazard: Other flammable materials	L:		L:
		C:		C:
		R:	See Section I Chapter 04	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					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \text{High}$	I = situation (eve	ent) of major concern				Likelihood				
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern			Α	U	EU	BEU		
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = 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	IV = situation (e	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)	nbəs		TTT	***	77.7	TX /		
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	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	)	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	G									
		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 5.10 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery	L:A	P – Store capacitors with terminals grounded	L:BEU
Exposure	present shock hazard.	C:M	P – Capacitor storage away from common areas	C:M
		R:II	P – Electrical worker training	R:IV
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,	Hazards: Burns caused by contact	L:U	P – Insulating guards/closed cabinets prevent incidental contact	L:BEU
High Current	with legacy conductors. The general	C:M	P – Electrical worker training	C:M
Exposure.	controls in Section I, Ch. 4 are not	R:II	P – Removal of metallic jewelry	R:IV
	applicable.		P – Conductors are posted as: "Caution High Current"	
	Dropped tools causing arc flash	L:U	P – Insulating guards/closed cabinets prevent incidental contact	L:BEU
		C:H	P – Electrical worker training	C:M
		R:I	P – Conductors are posted as: "Caution High Current"	R:IV
			M – Overcurrent protection	

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	I = situation (eve	ent) of major concern	Risk	Matri		lihood	DEII	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	sednences	Н	I II	I I	EU II	BEU III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	$C \ge Irreversible,$	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequ	L	III	III	IV IV	IV IV
Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		1				
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects $> \mathbf{C}$	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

 Table 5.11 Electrical Energy 1 Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery present	L:A	P – Store capacitors with terminals grounded	L:BEU
Exposure	shock hazard.	C:M	P – Capacitor storage away from common areas	C:M
		R:II	P – Electrical worker training	R:IV
High Voltage Exposure		L: C: R:	See Section I Chapter 04	L: C: R:
Low Voltage, High	Hazards: Burns caused by contact with legacy	L:U	P – Insulating guards/closed cabinets prevent incidental	L:BEU
Current Exposure.	conductors. The general controls in Section I,	C:M	contact	C:M
	Ch. 4 are not applicable.	R:II	P – Electrical worker training P – Removal of metallic jewelry P – Conductors are posted as: "Caution High Current"	R:IV
	Dropped tools causing arc flash	L:U		L:BEU
		С:Н	P – Insulating guards/closed cabinets prevent incidental	C:M
		R:I	contact P – Electrical worker training P – Conductors are posted as: "Caution High Current"	R:IV
			M – Overcurrent protection	

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	I = situation (eve	ent) of major concern	Risk	Matri		lihood	DEII	
U = Unlikely (1.0E-02> L >1.0E-04) EU = Extremely Unlikely (1.0E-04 > L >1.0E-06) BEU = Beyond Extremely Unlikely (1.0E-06> L)		$\mathbf{M} = \mathbf{Moderate}$ $\mathbf{L} = \mathbf{Low}$ $\mathbf{N} = \mathbf{Negligible}$		ent) of concern vent) of minor concern vent) of minimal concern	sednences	Н	I II	I I	EU II	BEU III IV
Control(s) Type  P = Preventive (reduce event occurrence likelihood)  M = Mitigative (reduces event consequences)	C H	$C \ge Irreversible,$	Onsite-2 (co-located worker) $C \ge \text{Prompt worker fatality}$	Onsite-1 (facility worker)  C ≥ Prompt worker	Consequ	L	III	III	IV IV	IV IV
Acronyms  MOI = Maximally-exposed Offsite Individual		other serious effects, or symptoms which could impair an individual's ability to take protective action.	or acute injury that is immediately life- threatening or permanently disabling.	fatality or acute injury that is immediately life- threatening or permanently disabling.		1				
	M	C ≥ Mild, transient adverse effects.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.	C ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects $> \mathbf{C}$	Minor injuries; no hospitalization > C	Minor injuries; no hospitalization > C						
	N	Consequences less than those for Low Consequence Level	Consequences less than hose for Low Consequence Level	Consequences less than those for Low Consequence Level						

Table 5.12 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Stored Energy	Hazard: Capacitors stored in gallery	L: BEU	No analysis required	L: BEU
Exposure	present shock hazard.	C: H		C: H
		R: III		R: III
High Voltage		L:	See Section I Chapter 04	L:
Exposure		C:		C:
		R:		R:
Low Voltage,	Hazards: Burns caused by contact	L: BEU	No analysis required	L: BEU
High Current	with legacy conductors. The general	C: H		C: H
Exposure.	controls in Section I, Ch. 4 are not applicable.	R: III		R: III
	Dropped tools causing arc flash			

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.  Likelihood (L, of event)/year   Consequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix								
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern						
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 (ev	ent) 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	2 (co-located worker)	Onsite-1 (facility worker)	sedn		***	***	77.7	77.7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,			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	٥	N	IV	IV	IV	IV
Acronyms		or symptoms which		nmediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threater	ning or permanently	threatening or						
		individual's ability to		disabling.	permanently disabling.						
		take protective		-							
		action.									
	M	C ≥ Mild, transient	<b>C</b> ≥ 3	Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	imme	diate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			hospit	talization required.	hospitalization required.						
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no						
		adverse effects > C	hos	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	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 5.13 Thermal Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		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   Consequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix								
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
<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
	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	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	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						
			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 fe	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 5.14 Thermal Energy – Onsite-2 Co-located Worker** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L: C:	See Section I Chapter 04	L: C:
		R:		R:
Hot work		L: C: R:	See Section I Chapter 04	L: C: R:
Cryogenics		L: C: R:	See Section I Chapter 04	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.  Likelihood (L, of event)/year   Consequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix								
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
<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
	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	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	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						
			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 fe	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 5.15 Thermal Energy – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Magnet Bakeouts		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Hot work		L:	See Section I Chapter 04	L:
		C:		C:
		R:		R:
Cryogenics		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   Consequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk	Matri	ix						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (evolution)	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		$\mathbf{L} = \text{Low}$		III = situation (ev	ent) 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	2 (co-located worker)	Onsite-1 (facility worker)	sedn	_	TTT	TIT	13.7	13.7
<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	hos	spitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Cons	sequences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 5.16 Kinetic Energy – Onsite-1 Facility Worker

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.  Likelihood (L, of event)/year   Consequence (C, of event)/year   Risk (R, Qualitative Ranking)   Risk Matrix											
Likelihood (L, of event)/year	C	onsequence (C, of event)/	Risk Matrix								
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = situation (evolution (evolution for evolution $	ent) of concern			A	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	nces	Н	I	I	II	III
<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
	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	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	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						
			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 fe	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 5.17 Kinetic Energy – Onsite-2 Co-located Worker** 

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

Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.												
Likelihood (L, of event)/year	Consequence (C, of event)/year			Risk (R, Qualitative Ranking)		Risk Matrix						
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$	$\mathbf{H} = \mathbf{High}$			<b>I</b> = situation (event) of major concern					Like	lihood		
U = Unlikely (1.0E-02> L > 1.0E-04)	$\mathbf{M} = \mathbf{M}$ oderate $\mathbf{L} = \mathbf{L}$ ow			II = situation (even	ent) of concern		1	A	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)				<b>III</b> = situation (e	vent) of minor concern	es	Н	I	I	II	III	
<b>BEU</b> = Beyond Extremely Unlikely $(1.0E-06>L)$	$\mathbf{N}$ = Negligible		<b>IV</b> = situation (event) of minimal concern		enc	M	II	II	III	IV		
M = Mitigative (reduces event consequences)  Acronyms  MOI = Maximally-exposed Offsite Individual	C Offsite (MOI)		Onsite	-2 (co-located worker) Onsite-1 (facility worker)		Consequences	L	III	III	IV	IV	
	Н	C ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action.	or i	Prompt worker fatality acute injury that is immediately life-tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N		IV	IV	IV	
	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 5.18 Kinetic Energy – MOI Offsite** 

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

Other Hazard Consequences, derived from Figure C-1	l, "E	xample Qualitative Con	sequer	nce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)	/year	Risk (R, Qualitative	Ranking)	Risk	Matr	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	ent) of major concern						
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		II = situation (even	ent) of concern		1	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	es	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)	Consequences	L	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 life-tening or permanently disabling.	C ≥ Prompt worker fatality or acute injury that is immediately lifethreatening or permanently disabling.	Con	N	IV	IV	IV	IV
	M L	C ≥ Mild, transient adverse effects.  Mild, transient adverse effects > C	imm per hosp	≥ Serious injury, no nediate loss of life no 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 5.19 Potential Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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/Piping		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	xample Qualitative Con	sequence Matrix", DOE-HD	DBK-1163-2020.									
Likelihood (L, of event)/year	C	onsequence (C, of event).	/year   Risk (R, Qualitative	Ranking)	Risk	Matri	X						
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	ent) of major concern				Likelihood					
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	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	uces	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (e	vent) of minimal concern	- a	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***		***				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Cons	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	ت	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	2										
		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									
		than those for Low	those for Low Consequence	those for Low									
		Consequence Level	Level	Consequence Level									

Table 5.20 Potential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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/Piping		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	sequen	ce Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event)/	/year	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \text{High}$		I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$		$\mathbf{II} = 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	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	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						
			pern	nanent disabilities;	permanent disabilities;						
			hospi	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						

 $Table \ 5.21 \ Potential \ Energy-MOI \ Offsite$ 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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/Piping		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	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)		$\mathbf{H} = \text{High}$	I = situation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \text{situation (ev}$	ent) of concern			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)	nbəs		TTT	***	***	TX /
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	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	)	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 5.22 Magnetic Fields – Onsite-1 Facility Worker** 

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

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	sequence Matrix"	, DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year Risk (R, C	Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = si	tuation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \mathbf{s}$	ituation (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	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-locate	d worker)	Onsite-1 (facility worker)	Consequences	_	***	***	77.7	TX 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt work$	er fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury	-	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately		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.						
		take protective	•								
		action.									
	M	C ≥ Mild, transient	C ≥ Serious in	ury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss	of life no	immediate loss of life no						
			permanent disa	bilities;	permanent disabilities;						
			hospitalization	equired.	hospitalization required.						
	L	Mild, transient	Minor injurie	es; no	Minor injuries; no						
		adverse effects > C	hospitalizatio	n > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences 1	ess than	Consequences less than						
		than those for Low	those for Low Co	nsequence	those for Low						
		Consequence Level	Level		Consequence Level						

**Table 5.23 Magnetic Fields – Onsite-2 Co-located Worker** 

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

Other Hazard Consequences, derived from Figure C-1	, "E	xample Qualitative Cons	sequence Matrix"	, DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year Risk (R, C	Qualitative	Ranking)	Risk	Matri	X			
$\mathbf{A} = \text{Anticipated (L} > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	I = si	tuation (eve	ent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{II} = \mathbf{s}$	ituation (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	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-locate	d worker)	Onsite-1 (facility worker)	Consequences	_	***	***	77.7	TX 7
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt work$	er fatality	C ≥ Prompt worker	ons	L	III	III	IV	IV
<b>M</b> = Mitigative (reduces event consequences)		other serious effects,	or acute injury	-	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately		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.						
		take protective	•								
		action.									
	M	C ≥ Mild, transient	C ≥ Serious in	ury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss	of life no	immediate loss of life no						
			permanent disa	bilities;	permanent disabilities;						
			hospitalization	equired.	hospitalization required.						
	L	Mild, transient	Minor injurie	es; no	Minor injuries; no						
		adverse effects > C	hospitalizatio	n > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences 1	ess than	Consequences less than						
		than those for Low	those for Low Co	nsequence	those for Low						
		Consequence Level	Level		Consequence Level						

**Table 5.24 Magnetic Fields – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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 Conse	equence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/y	ear Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0\text{E}-02)$		$\mathbf{H} = \mathbf{High}$	$\mathbf{I} = \text{situation (eve}$	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)		$\mathbf{L} = \text{Low}$	<b>III</b> = situation (ex	vent) of minor concern	ક	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)	sednences	_				
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Cons	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	ప	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	disasing.	permanently disusting.						
		action.								
	M	C ≥ Mild, transient	C ≥ Serious injury, no	C ≥ Serious injury, no						
		adverse effects.	immediate loss of life no	immediate loss of life no						
			permanent disabilities;	permanent disabilities;						
			hospitalization required.	hospitalization required.						
	L	Mild, transient	Minor injuries; no	Minor injuries; no						
		adverse effects > C	hospitalization > C	hospitalization $> \mathbf{C}$						
	N	Consequences less	Consequences less than	Consequences less than						
		than those for Low the	hose for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.25 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:
Working at Heights		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, Qualitativ	e Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (ev	vent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation } (\mathbf{e})$	event) of concern	l —	1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (	event) of minor concern	ક	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (	event) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***		***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Cons	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	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 permanently							
		individual's ability to	disabling.	permanently disabling.						
		take protective	<i>B</i>							
		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	1					
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.26 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:
Working at Heights		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   F	Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$		I = situation (eve	nt) of major concern				Like	lihood	
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)		$\mathbf{L} = \text{Low}$		III = situation (ev	vent) of minor concern	se	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2	(co-located worker)	Onsite-1 (facility worker)	nbəs	т .	III	III	IV	IV
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	C ≥ Pro	ompt worker fatality	C ≥ Prompt worker	Cons	L	111	Ш	1 V	1 V
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,		cute injury that is	fatality or acute injury that	0	N	IV	IV	IV	IV
Acronyms		or symptoms which		mediately life-	is immediately life-						
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threaten	ning or permanently	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;						
			hospita	alization required.	hospitalization required.						
	L	Mild, transient	Mir	nor injuries; no	Minor injuries; no						
		adverse effects > C		pitalization > C	hospitalization > C						
	N	Consequences less		equences less than	Consequences less than						
			those for	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

**Table 5.27 Other hazards – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Confined Spaces		L: C: R:	See Section I Chapter 04	L: C: R:
Noise		L: C: R:	See Section I Chapter 04	L: C: R:
Silica		L: C: R:	See Section I Chapter 04	L: C: R:
Ergonomics		L: C: R:	See Section I Chapter 04	L: C: R:
Asbestos		L: C: R:	See Section I Chapter 04	L: C: R:
Working at Heights		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, Qualitativ	e Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (ev	vent) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation } (\mathbf{e})$	event) of concern	l —	1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	III = situation (	event) of minor concern	ક	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (	event) of minimal concern	ences	M	II	II	III	IV
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		***		***	
<b>P</b> = Preventive (reduce event occurrence likelihood)	Н	C ≥ Irreversible,	$C \ge Prompt worker fatality$	C ≥ Prompt worker	Cons	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	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 permanently							
		individual's ability to	disabling.	permanently disabling.						
		take protective	<i>B</i>							
		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	1					
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.28 Access & Egress – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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	year Risk (R, Qualitative	Ranking)	Risk	Matri	ix			
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (ever	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L > 1.0E-04)		$\mathbf{M} = \mathbf{Moderate}$	<b>II</b> = situation (eve	ent) 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 (ev	vent) of minor concern	ses	Н	I	I	II	III
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	<b>IV</b> = 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	,	TTT	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
$\mathbf{M} = \text{Mitigative (reduces event consequences)}$		other serious effects,	or acute injury that is	fatality or acute injury that	5	N	IV	IV	IV	IV
Acronyms		or symptoms which	immediately life-	is immediately life-						
<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	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

Table 5.29 Access & Egress – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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	l, "F	<b>Example Qualitative Con</b>	sequence Matrix", DOE-HD	BK-1163-2020.						
Likelihood (L, of event)/year	C	onsequence (C, of event).	year Risk (R, Qualitative	Ranking)	Risk Matrix					
$\mathbf{A} = \text{Anticipated } (L > 1.0E-02)$		$\mathbf{H} = \mathbf{High}$	I = situation (eve	nt) 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	<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	IV = situation (evolution)	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	***	***
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	$C \ge Prompt worker fatality$	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	5	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	Ç							
		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						
		than those for Low	those for Low Consequence	those for Low						
		Consequence Level	Level	Consequence Level						

**Table 5.30 Access & Egress – MOI Offsite** 

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventive (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)/	year   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)		$\mathbf{M} = \mathbf{Moderate}$	$\mathbf{H} = \text{situation (ev}$	ent) of concern			A	U	EU	BEU			
EU = Extremely Unlikely (1.0E-04 > L > 1.0E-06)		L = Low	<b>III</b> = situation (ex	vent) of minor concern	es	Н	I	I	II	III			
<b>BEU</b> = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	vent) of minimal concern	ences	M	II	II	III	IV			
Control(s) Type	C	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		TTT	***	77.7	***			
<b>P</b> = Preventive (reduce event occurrence likelihood)	H	C ≥ Irreversible,	C ≥ Prompt worker fatality	C ≥ Prompt worker	Cons	L	III	III	IV	IV			
<b>M</b> = 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-					•	<u> </u>			
<b>MOI</b> = Maximally-exposed Offsite Individual		could impair an	threatening or permanently	threatening or									
		individual's ability to	disabling.	permanently disabling.									
		take protective	J										
		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									
	L		permanent disabilities;	permanent disabilities;									
			hospitalization required.	hospitalization required.									
		Mild, transient	Minor injuries; no	Minor injuries; no	1								
		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 5.31 Environmental** 

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