Table 9. Summary of Baseline and Residual Risks - NOvA Near Detector

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

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

NOTE:

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

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

Table 9.1 Toxic Materials – Onsite 1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Liquid Scintillator	Hazard: NOvA's liquid scintillator oil contains 5.35% pseudocumene. The pseudocumene is an eyes, skin and respiratory irritant, central nervous system depressant, and is toxic to marine life. Physical contact via handling or airborne exposure via outgassing oil	L: A C: L R: III	 P - A job-specific hazard analysis and procedure govern filling the detector and prescribe Personal Protective Equipment (PPE) to prevent worker contact with the liquid scintillator. P - The PVC modules, once filled, completely contain the pseudocumene, resulting in no further exposure. P - The entire detector is inside of a secondary containment membrane that has the capacity to contain 100% of the liquid scintillator oil and prevent a release to the environment. M - Emergency spill equipment, an eye wash and PPE are stationed near the detector in the event of a release. 	L: BEU C: N R: IV

Likelihood (L, of event)/year	Co	nsequence (C, of event),	/year	Risk (R, Qualitative Ranking)		Risk Matrix					
A = Anticipated (L > 1.0E-02)		H = High		I = situation (event) of major concern					Likel	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate L = Low		II = situation (event) of concern				Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)				III = situation (ev	rent) of minor concern	ces	Н	I	1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	√ = Negligible		IV = situation (event) of minimal concern			Ш	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	nbə		Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	н	C ³ PAC-2		C ³ PAC-3	C 3 IDLH	Cons				1 V	1 V
M = Mitigative (reduces event consequences)	м	PAC-2 > C ³ PAC-1	F	PAC-3 > C ³ PAC-2	IDLH > C 3 PEL or TLVc		N	IV	IV	IV	IV
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or TLV _c > C						
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual		Consequences less than those for Low		sequences less than for Low Consequence	Consequences less than those for Low						
PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLV _c = Threshold Limit Value (ceiling)		Consequence Level		Level	Consequence Level						

Table 9.2 Toxic Materials – Onsite 2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Liquid Scintillator	Hazard: NOvA's liquid scintillator oil contains 5.35% pseudocumene. The pseudocumene is an eyes, skin and respiratory irritant, central nervous system depressant, and is toxic to marine life. Airborne exposure via outgassing oil	L: A C: L R: III	 P - A job-specific hazard analysis and procedure govern filling the detector to prevent spilling and exposing the liquid scintillator. P - The PVC modules, once filled, completely contain the pseudocumene, resulting in no further exposure. P - The entire detector is inside of a secondary containment membrane that has the capacity to contain 100% of the liquid scintillator oil and prevent a release to the environment. M - Emergency spill equipment, an eye wash and PPE are stationed near the detector in the event of a release. 	L: BEU C: N R: IV

Chemical Hazard Consequences, derived from Figure C-	1, "Ex	cample Qualitative Cons	equen	ce Matrix", DOE-HDBK	-1163-2020.									
Likelihood (L, of event)/year	Co	nsequence (C, of event)	/year	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)				Risk Matrix					
A = Anticipated (L > 1.0E-02)	H = High		I = situation (eve	I = situation (event) of major concern										
U = Unlikely (1.0E-02> L >1.0E-04)	M = Moderate		II = situation (ev	ent) of concern			Α	U	EU	BEU				
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)	L = Low		III = situation (ev	tion (event) of minor concern		Н	- 1	- 1	П	Ш				
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern			М	П	Ш	Ш	IV			
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces		III	Ш	IV	IV			
P = Preventive (reduce event occurrence likelihood)	Н	C ³ PAC-2		C ³ PAC-3	C 3 IDLH	Cons	_							
M = Mitigative (reduces event consequences)	М	PAC-2 > C ³ PAC-1	F	PAC-3 > C ³ PAC-2	IDLH > C 3 PEL or TLVc		N	IV	IV	IV	IV			
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or TLVc > C									
IDLH = Immediately Dangerous to Life and Health MOI = Maximally-exposed Offsite Individual PAC = Protective Action Criteria PEL = Permissible Exposure Limit TLVc = Threshold Limit Value (ceiling)	N	Consequences less than those for Low Consequence Level		sequences less than for Low Consequence Level	Consequences less than those for Low Consequence Level									

Table 9.3 Toxic Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Liquid Scintillator	Hazard: NOvA's liquid scintillator oil contains 5.35% pseudocumene. The pseudocumene is an eyes, skin and respiratory irritant, central nervous system depressant, and is toxic to marine life. Airborne	L: EU C: N R: IV	 P - Access controls to area prevent contact. P - The PVC modules, once filled, completely contain the pseudocumene, resulting in no further exposure. P - The entire detector is inside of a secondary containment membrane that has the capacity to contain 100% of the liquid scintillator oil and prevent a release to the environment. 	L: BEU C: N R: IV

Chemical Hazard Consequences, derived from Figure C-	1, "Ex	cample Qualitative Cons	equen	ce Matrix", DOE-HDBK	-1163-2020.						
Likelihood (L, of event)/year	Co	nsequence (C, of event)	/year	Risk (R, Qualitative F	tanking)	Risk Matrix					
A = Anticipated (L > 1.0E-02)	H = High		I = situation (eve	I = situation (event) of major concern				Like	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)	M = Moderate		II = situation (ev	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	(event) of minor concern		Н	I	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	lenc	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedneuces		Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ PAC-2		C ³ PAC-3	C 3 IDLH	Cons					
M = Mitigative (reduces event consequences)	М	PAC-2 > C ³ PAC-1	F	PAC-3 > C ³ PAC-2	IDLH > C 3 PEL or TLVc		N	IV	IV	IV	IV
Acronyms	L	PAC-1 > C		PAC-2 > C	PEL or TLV _c > C						
IDLH = Immediately Dangerous to Life and Health	N	Consequences less	Con	sequences less than	Consequences less than						
MOI = Maximally-exposed Offsite Individual		than those for Low		for Low Consequence	those for Low						
PAC = Protective Action Criteria		Consequence Level		Level	Consequence Level						
PEL = Permissible Exposure Limit		2011204401100 20101		2010.	compaquemee zeven						
TLV _c = Threshold Limit Value (ceiling)											

Table 9.4 Flammable and Combustible Materials – Onsite -1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
Flammable	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	Risk (R, Qualitative Ranking)			I			
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	I = situation (event) of major concern				Likel	ihood	,
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	II = situation (event) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	- 1	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	enc	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbə	1	III	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other		rompt worker fatality	C ³ Prompt worker fatality	Cons	N	IV	IV	IV	IV
Acronyms		serious effects, or symptoms which		acute injury that is immediately life-	or acute injury that is immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									

M	C ³ Mild, transient	C ³ Serious injury, no	C ³ 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 9.5 Flammable and Combustible Materials – Onsite -2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
Flammable	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Other Hazard Consequences, derived from Figure C-1, "	Exan	nple Qualitative Consequ	uence N	Matrix", DOE-HDBK-116	53-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	situation (event) of major concern				Like	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	ces	Н	- 1	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	e	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	ı	III	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ Irreversible, other	C ³ P	rompt worker fatality	C ³ Prompt worker fatality	Cons					
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									

M	C ³ Mild, transient	C ³ Serious injury, no	C ³ 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 9.6 Flammable and Combustible Materials – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Combustible	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
materials		C:		C:
(cables, Boxes,		R:		R:
Paper, wood				
cribbing, etc.)				
Flammable	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Materials		C:		C:
(Flammable gas,		R:		R:
cleaning				
materials, etc.)				

Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	= situation (event) of major concern				Likel	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		ı	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	I	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	enc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs		Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or		rompt worker fatality acute injury that is	C ³ Prompt worker fatality or acute injury that is	Cons	N	IV	IV	IV	IV
Acronyms MOI = Maximally-exposed Offsite Individual		symptoms which could impair an		immediately life- threatening or	immediately life- threatening or						
, .		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective action.									

M	C ³ Mild, transient	C ³ Serious injury, no	C ³ 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 9.7 Electrical Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Exposure		C:		C:
-		R:		R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year Risk (R, Qu	alitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High	I = situ	ation (eve	nt) of major concern				Like	lihood	-
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	II = sit	uation (eve	ent) of concern		ı	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	III = sit	tuation (ev	rent) of minor concern	es	Н	ı	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = si	tuation (ev	vent) of minimal concern	enc	М	Ш	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located	worker)	Onsite-1 (facility worker)	Consequences		III	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or	C ³ Prompt worke or acute injury	•	C ³ Prompt worker fatality or acute injury that is	Cons	N	IV	IV	IV	IV
Acronyms		symptoms which	immediately		immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening		threatening or						
		individual's ability to	permanently dis		permanently disabling.						
		take protective	F,		p a manana, a a a a a a a a a a a a a a a a a						
		action.									
	М	C ³ Mild, transient	C ³ Serious inju	ry, no	C ³ Serious injury, no						
		adverse effects.	immediate loss o	f life no	immediate loss of life no						
			permanent disal	bilities;	permanent disabilities;						
			hospitalization re	equired.	hospitalization required.						
	L	Mild, transient	Minor injuries	s; no	Minor injuries; no						
		adverse effects > C	hospitalizatio	n > C	hospitalization > C						
	N	Consequences less	Consequences le	ess than	Consequences less than						
		than those for Low	those for Low Con	sequence	those for Low						
		Consequence Level	Level		Consequence Level						

Table 9.8 Electrical Energy Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage	Hazard:	L:	See Section 1, Chapter 4.	L:
Exposure		C:		C:
		R:		R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)/y	ear Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High	I = situation (ever	nt) of major concern				Like	lihood	1
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	II = situation (eve	ent) of concern	l		Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	III = situation (eve	ent) of minor concern	ces	Н	I	- 1	Ш	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	ent) of minimal concern	e	М	П	П	111	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedu		Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or	C ³ Prompt worker fatality or acute injury that is	C ³ Prompt worker fatality or acute injury that is	Cons	N	IV	IV	IV	IV
Acronyms		symptoms which	immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	threatening or	threatening or						
		individual's ability to	permanently disabling.	permanently disabling.						
		take protective	, ,	, ,						
		action.								
	М	C ³ Mild, transient	C ³ Serious injury, no	C ³ 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 9.9 Electrical Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
High Voltage	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Exposure		C:		C:
		R:		R:

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

Table 9.10 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	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative Ra	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (ever	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern			ı	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	ces	Н	- 1	- 1	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	en	М	П	П	111	IV
Control(s) Type	С	Offsite (MOI)			Onsite-1 (facility worker)	nbəs	L	Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or	· ·		C ³ Prompt worker fatality or acute injury that is	Con	N	IV	IV	IV	IV
Acronyms		symptoms which	,		immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to		nanently disabling.	permanently disabling.						
		take protective		, 0	, ,						
		action.	e protective action.								
	М	C ³ Mild, transient	versible, other us effects, or or acurotoms which Id impair an Iual's ability to e protective action. Iild, transient erse effects. C 3 Promore or acurother immedia permanent immedia permane		C ³ Serious injury, no						
		adverse effects.	imme	ediate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			d impair an thi perma e protective action. ild, transient erse effects.		hospitalization required.						
	L	Mild, transient	M	linor injuries; no	Minor injuries; no						
		adverse effects > C	ho	spitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.11 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	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year '	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (ever	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (event) of concern				Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	L = Low		ent) of minor concern	Ges	Н	- 1	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	e	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (Onsite-1 (facility worker)	sedu	L	III	III	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or	·		C ³ Prompt worker fatality or acute injury that is	Con	N	IV	IV	IV	IV
Acronyms		symptoms which	, and the second		immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an			threatening or						
		individual's ability to		manently disabling.	permanently disabling.						
		take protective	take protective								
		action.	ge protective action.								
	М	C ³ Mild, transient	C ³	³ Serious injury, no	C ³ Serious injury, no						
		adverse effects.	imm	ediate loss of life no	immediate loss of life no						
			per	manent disabilities;	permanent disabilities;						
			vidual's ability to ake protective action. Mild, transient dverse effects. C 3 Serior immediate permaner hospitaliza		hospitalization required.						
	L	Mild, transient	١	Minor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization > C						
	N	Consequences less	Con	sequences less than	Consequences less than						
		than those for Low	those	for Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.12 Thermal Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hot Work	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low			III = situation (event) of minor concern		Н	- 1	- 1	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	М	П	П	111	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2	(co-located worker)	Onsite-1 (facility worker)	nbə		Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or		ompt worker fatality cute injury that is	C ³ Prompt worker fatality or acute injury that is	Consequences	N	IV	IV	IV	IV
Acronyms		symptoms which		nmediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		hreatening or	threatening or						
		individual's ability to		nanently disabling.	permanently disabling.						
		take protective	•	, 0							
		action.									
	М	C ³ Mild, transient	C ³ S	Serious injury, no	C ³ Serious injury, no						
		adverse effects.	immed	diate loss of life no	immediate loss of life no						
			perm	nanent disabilities;	permanent disabilities;						
			hospit	talization required.	hospitalization required.						
	L	Mild, transient	Mi	inor injuries; no	Minor injuries; no						
		adverse effects > C	hos	spitalization > C	hospitalization > C						
	N	Consequences less	Conse	equences less than	Consequences less than						
		than those for Low	those fo	or Low Consequence	those for Low						
		Consequence Level		Level	Consequence Level						

Table 9.13 Kinetic Energy – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power Tools	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
		C:		C:
		R:		R:
Pumps and	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Motors		C:		C:
		R:		R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year	Risk (R, Qualitative R	tanking)	Risk Matrix						
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	ent) of major concern				Like	lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (ev	ent) of concern			Α	U	EU	BEU	
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	es	Н	- 1	- 1	П	Ш	
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ences	М	П	П	Ш	IV	
Control(s) Type	С			2 (co-located worker)	Onsite-1 (facility worker)	Conseque	L	Ш	Ш	IV	IV	
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	,		ompt worker fatality acute injury that is	C ³ Prompt worker fatality or acute injury that is	Con	N	IV	IV	IV	IV	
Acronyms		,		mmediately life-	immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an	t	threatening or	threatening or							
		serious effects, or symptoms which could impair an individual's ability to take protective action. C 3 Mild, transient C 3 3		nanently disabling.	permanently disabling.							
		take protective										
		action.										
	М	could impair an threa individual's ability to take protective action. C 3 Mild, transient C 3 Serio		Serious injury, no	C ³ Serious injury, no							
		adverse effects.	imme	ediate loss of life no	immediate loss of life no							
			perm	nanent disabilities;	permanent disabilities;							
		· ·		italization required.	hospitalization required.							
	L	Mild, transient	М	linor injuries; no	Minor injuries; no							
		adverse effects > C	ho	ospitalization > 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 9.14 Kinetic Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power Tools	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
		C:		C:
		R:		R:
Pumps and	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Motors		C:		C:
		R:		R:

Likelihood (L, of event)/year	Co	nsequence (C, of event)/	year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (event) of major concern							
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	Se	Н	- 1	I	Ш	111
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	enc	М	П	П	111	IV
Control(s) Type	С			e-2 (co-located worker)	Onsite-1 (facility worker)	Consequences	L	Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н			rompt worker fatality acute injury that is	C ³ Prompt worker fatality or acute injury that is	Con	N	IV	IV	IV	IV
Acronyms MOI = Maximally-exposed Offsite Individual		symptoms which could impair an individual's ability to take protective action.	i	immediately life- threatening or manently disabling.	immediately life- threatening or permanently disabling.						
	M	symptoms which could impair an individual's ability to take protective action. C 3 Mild, transient adverse effects. immediate to permanent of the permanent of		³ Serious injury, no nediate loss of life no manent disabilities; pitalization required.	C ³ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C		Minor injuries; no nospitalization > C	Minor injuries; no hospitalization > C						

Table 9.15 Kinetic Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Power Tools	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
		C:		C:
		R:		R:
Pumps and	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Motors		C:		C:
		R:		R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Likel	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	M = Moderate		ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	L = Low		ent) of minor concern	ces	Н	I	I	Ш	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		enc	М	П	П	111	IV
Control(s) Type	С			-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	L	Ш	Ш	IV	IV
 P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual 	Н	C ³ Irreversible, other serious effects, or symptoms which could impair an	or i	rompt worker fatality acute injury that is immediately life- threatening or	C ³ Prompt worker fatality or acute injury that is immediately life- threatening or	Con	N	IV	IV	IV	IV
		symptoms which could impair an individual's ability to take protective action. C 3 Mild, transient C 3 Ser		manently disabling.	permanently disabling.						
	М	C ³ Mild, transient adverse effects.	could impair an dividual's ability to take protective action. C 3 Mild, transient adverse effects. C 3 Feri immediate permane hospitalization.		C ³ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient adverse effects > C		Minor injuries; no nospitalization > C	Minor injuries; no hospitalization > C						

Table 9.16 Potential Energy – Onsite-1 Facility Worker

Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hazard: N/A	L:	See Section 1, Chapter 4.	L:
	C:		C:
	R:		R:
Hazard: N/A	L:	See Section 1, Chapter 4.	L:
	C:		C:
	R:		R:
Hazard: N/A	L:	See Section 1, Chapter 4.	L:
	C:		C:
	R:		R:
	Hazard: N/A Hazard: N/A	Hazard Description Risk (without controls) Hazard: N/A L: C: R: Hazard: N/A L: C: R: Hazard: N/A L: C: C: R:	Hazard Description Risk (without controls) Hazard: N/A L: See Section 1, Chapter 4. C: R: Hazard: N/A L: See Section 1, Chapter 4. C: R: Hazard: N/A L: See Section 1, Chapter 4. C: R: See Section 1, Chapter 4. C: R:

Likelihood (L, of event)/year	Co	onsequence (C, of event),	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Likel	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (ev	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	rent) of minor concern	es	Н	I	-	Ш	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	iences	М	Ш	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	ı	Ш	Ш	IV	IV
 P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual 	Н	C ³ Irreversible, other serious effects, or symptoms which could impair an individual's ability to	or i	rompt worker fatality acute injury that is immediately life- threatening or rmanently disabling.	C ³ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Cons	N	IV	IV	IV	IV
	М	take protective action. C ³ Mild, transient adverse effects.	C imm	³ Serious injury, no	C ³ Serious injury, 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 9.17 Potential Energy – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
ompressed	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
asses		C:		C:
		R:		R:
acuum /	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
ressure		C:		C:
essels/ Piping		R:		R:
/laterial	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
landling		C:		C:
		R:		R:
/laterial	Hazard: N/A	L: C:	See Section 1, Chapter 4.	

Likelihood (L, of event)/year	Co	onsequence (C, of event),	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Likel	ihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	vent) of minor concern	S	Н	I	1	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	iences	М	Ш	=	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	edn	ı	Ш	III	IV	IV
 P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences) Acronyms MOI = Maximally-exposed Offsite Individual 	Н	C ³ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective	or i	rompt worker fatality acute injury that is immediately life- threatening or manently disabling.	C ³ Prompt worker fatality or acute injury that is immediately life- threatening or permanently disabling.	Cons	N	IV	IV	IV	IV
	М	action. C ³ Mild, transient adverse effects.		³ Serious injury, no nediate loss of life no	C ³ Serious injury, 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 9.18 Potential Energy – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Compressed	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Gasses		C:		C:
		R:		R:
Vacuum /	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Pressure		C:		C:
Vessels/ Piping		R:		R:
Material	Hazard: N/A	L:	See Section 1, Chapter 4.	L:
Handling		C:		C:
•		R:		R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	Ses	Н	- 1	- 1	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	-2 (co-located worker)	Onsite-1 (facility worker)	sedn	ı	Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ Irreversible, other	C ³ P	rompt worker fatality	C ³ Prompt worker fatality	Cons					
M = Mitigative (reduces event consequences)		serious effects, or	or	acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						
		take protective									
		action.									
	М	C ³ Mild, transient	C	³ Serious injury, no	C ³ Serious injury, no						
		adverse effects.	imm	nediate loss of life no	immediate loss of life no						

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

Table 9.19 Other hazards – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Noise	Hazard: N/A	L: C:	See Section 1, Chapter 4.	L: C:
		R:		R:
Silica	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Ergonomics	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Working at Heights	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	rent) of minor concern	ces	Н	- 1	- 1	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	vent) of minimal concern	e	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	nbəs	ı	Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood)	н	C ³ Irreversible, other	C ³ P	rompt worker fatality	C ³ Prompt worker fatality	Cons	-				
M = Mitigative (reduces event consequences)		serious effects, or		acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						

	take protective		
	action.		
М	C ³ Mild, transient	C ³ Serious injury, no	C 3 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 9.20 Other hazards – Onsite-2 Co-located Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Noise	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Silica	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Ergonomics	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Working at Heights	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	onsequence (C, of event)	/year	Risk (R, Qualitative Ranking)			Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (event) of major concern					Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	M = Moderate		II = situation (event) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	L = Low		ent) of minor concern	Ses	Н	- 1	1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ation (event) of minimal concern		М	П	П	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn	ı	Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood)	н	C ³ Irreversible, other	C ³ P	rompt worker fatality	C ³ Prompt worker fatality	Cons					
M = Mitigative (reduces event consequences)		serious effects, or		acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	rmanently disabling.	permanently disabling.						

	take protective		
	action.		
М	C ³ Mild, transient	C ³ Serious injury, no	C 3 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 9.21 Other hazards – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Noise	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Silica	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Ergonomics	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Working at Heights	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Other Hazard Consequences, derived from Figure C-1, "	Exan	nple Qualitative Conseque	ence N	//atrix", DOE-HDBK-116	3 3-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year	Risk (R, Qualitative Ranking)			Matrix	(
A = Anticipated (L > 1.0E-02)		H = High	H = High		I = situation (event) of major concern				Likelihood		
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	ent) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	L = Low		ent) of minor concern	ses	Н	ı	I	II	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (ev	ent) of minimal concern	lenc	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	sedr	L	Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ Irreversible, other	C ³ Pi	rompt worker fatality	C ³ Prompt worker fatality	Son					
M = Mitigative (reduces event consequences)		serious effects, or		acute injury that is	or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	manently disabling.	permanently disabling.						

	take protective		
	action.		
М	C ³ Mild, transient	C ³ Serious injury, no	C 3 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 9.22 Access & Egress – Onsite-1 Facility Worker

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Egress	hazardous area in case of an emergency. In the MINOS Underground, this would be an ODH or fire alarm. In the MINOS Surface Building, this would be a fire alarm or tornado warning.	C: H R: I	Training. The most important part of this training concerns Life Safety Egress. P- In the case of a power outage, all Life Safety systems are powered by a large diesel generator: emergency lights, elevators, cranes (so the personnel basket to underground can be used), and air handling units (AHUs). M- First action on hearing an ODH or fire alarm underground is to exit to the Positive Pressure Emergency Passageway which should prevent smoke or toxic fumes from entering the area. M- Normally, workers should exit the underground via the main elevator. In the event the elevator is not working, the group should first call the emergency number X3131. If instructed to do so, the group should use the Secondary Escape Route explained in the MINOS Underground training	C: N R: IV
			and indicated with signs. The group may also be instructed to carry or use Emergency Escape Breathing Devices (EEBDs). M- In the MINOS Surface Building, workers should go to the Assembly Area in the parking lot in the case of a fire alarm and go to the Tornado Shelter in the mechanical room in the case of a tornado warning.	

Likelihood (L, of event)/year	Co	onsequence (C, of event),	year Risk (R, Qualitative Ra	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High	•	I = situation (event) of major concern				lihood		
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	II = situation (eve	II = situation (event) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	III = situation (eve	ent) of minor concern	es	Н	- 1	- 1	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	ent) of minimal concern	ences	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	sedn	L	Ш	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ Irreversible, other	³ Irreversible, other C ³ Prompt worker fatality C ³ P		Cons		- '''		• •	
M = Mitigative (reduces event consequences)		serious effects, or	serious effects, or or acute injury that is			N	IV	IV	IV	IV
Acronyms		symptoms which	immediately life-	immediately life-						
MOI = Maximally-exposed Offsite Individual		could impair an	could impair an threatening or							
		individual's ability to	,							
		take protective	take protective							
		action.								
	М	C ³ Mild, transient	C ³ Serious injury, no	C 3 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 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	Hazard: Inability to leave	L: A	P- All MINOS Underground workers must take MINOS Underground	L: EU
Egress	hazardous area in case of an emergency. In the MINOS Underground, this would be an ODH or fire alarm. In the MINOS Surface Building, this would be a fire alarm or tornado warning.	C: H R: I	Training. All tourists must receive a Safety Briefing, and sign a tour sheet to indicate they received this. The most important part of these concern Life Safety Egress. P- In the case of a power outage, all Life Safety systems are powered by a large diesel generator: emergency lights, elevators, cranes (so the personnel basket to underground can be used), and air handling units (AHUs). M- First action on hearing an ODH or fire alarm underground is to exit to the Positive Pressure Emergency Passageway which should prevent smoke or toxic fumes from entering the area. M- Normally, workers should exit the underground via the main elevator. In the event the elevator is not working, the group should first call the emergency number X3131. If instructed to do so, the group should use the Secondary Escape Route explained in the MINOS Underground training or the Safety Briefing for tourists and indicated with signs. The group may also be instructed to carry or use Emergency Escape Breathing Devices (EEBDs). M- In the MINOS Surface Building, workers should go to the Assembly Area in the parking lot in the case of a fire alarm, and go to the Tornado Shelter in the mechanical room in the case of a tornado warning.	C: N R: IV

Other Hazard Consequences, derived from Figure C-1, "	Exar	nple Qualitative Conseque	ence Matrix", DOE-HDBK-116	3-2020.						
Likelihood (L, of event)/year	Co	onsequence (C, of event)/	year Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High	I = situation (eve	I = situation (event) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate	II = situation (eve	situation (event) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low	III = situation (ev	ent) of minor concern	S S	Н	ı	- 1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible	IV = situation (ev	ent) of minimal concern	iences	М	II	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite-2 (co-located worker)	Onsite-1 (facility worker)	nbəsı	ı	III	Ш	IV	IV
P = Preventive (reduce event occurrence likelihood)	Н	C ³ Irreversible, other C ³ Prompt worker fatality C ³ F		C ³ Prompt worker fatality	Cons	_				
M = Mitigative (reduces event consequences)		serious effects, or or acute injury that is		or acute injury that is		N	IV	IV	IV	IV
Acronyms		symptoms which	symptoms which immediately life-							
MOI = Maximally-exposed Offsite Individual		could impair an threatening or		threatening or						
		individual's ability to								
		take protective								
		action.								
	М	C ³ Mild, transient	C 3 Serious injury, no	C 3 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 Access & Egress – MOI Offsite

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Life Safety Egress	Hazard: There are no life safety egress hazards outside the MINOS Surface Building.	L: BEU C: N R: IV	No further analysis required.	L: BEU C: N R: IV

Likelihood (L, of event)/year	C	onsequence (C, of event)/y	ear	Risk (R, Qualitative R	anking)	Risk	Matrix				
A = Anticipated (L > 1.0E-02)		H = High		I = situation (eve	nt) of major concern				Likel	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)		M = Moderate		II = situation (eve	II = situation (event) of concern			Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (event) of minor concern		ces	Н	I	I	П	Ш
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		eu	М	Ш	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Offsite (MOI) Onsite-2 (co-located worker) O		Onsite-1 (facility worker)	sedn	L	Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood) M = Mitigative (reduces event consequences)	Н	,		rompt worker fatality	C ³ Prompt worker fatality	Con	N	IV	IV	IV	IV
* * **		symptoms which could impair an individual's ability to take protective action.	i	acute injury that is immediately life- threatening or manently disabling.	or acute injury that is immediately life- threatening or permanently disabling.						
	М	C ³ Mild, transient adverse effects.	imm per	Serious injury, no nediate loss of life no manent disabilities; pitalization required.	C ³ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required.						
	L	Mild, transient	N	Minor injuries; no	Minor injuries; no						
		adverse effects > C	h	ospitalization > C	hospitalization > C						

N	V	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 9.25 Environmental Hazards

Hazard	Hazard Description	Baseline Qualitative Risk (without controls)	Preventative (P)/ Mitigative (M)	Residual Qualitative Risk (with controls)
Hazard to Air	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Hazard to Water	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:
Hazard to Soil	Hazard: N/A	L: C: R:	See Section 1, Chapter 4.	L: C: R:

Likelihood (L, of event)/year	Co	Consequence (C, of event)/year		Risk (R, Qualitative Ranking)			Matrix				
A = Anticipated (L > 1.0E-02)		H = High M = Moderate		I = situation (eve	event) of major concern				Like	lihood	
U = Unlikely (1.0E-02> L >1.0E-04)				II = situation (eve	ent) of concern		1	Α	U	EU	BEU
EU = Extremely Unlikely (1.0E-04 > L >1.0E-06)		L = Low		III = situation (ev	ent) of minor concern	es	Н	- 1	- 1	П	III
BEU = Beyond Extremely Unlikely (1.0E-06> L)		N = Negligible		IV = situation (event) of minimal concern		ences	М	П	Ш	Ш	IV
Control(s) Type	С	Offsite (MOI)	Onsite	e-2 (co-located worker)	Onsite-1 (facility worker)	edn		Ш	III	IV	IV
P = Preventive (reduce event occurrence likelihood)M = Mitigative (reduces event consequences)	Н	C ³ Irreversible, other serious effects, or		rompt worker fatality acute injury that is	C ³ Prompt worker fatality or acute injury that is	Cons	N	IV	IV	IV	IV
Acronyms		symptoms which		immediately life-	immediately life-				•		
MOI = Maximally-exposed Offsite Individual		could impair an		threatening or	threatening or						
		individual's ability to	per	rmanently disabling.	permanently disabling.						

		T	
	take protective		
	action.		
М	C 3 Mild, transient	C 3 Serious injury, no	C 3 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