Project Information:	Project Scope:		Contacts:		
The Creamery	Ammonia Refrigeration System:		Fernando Ortiz - Plant manager		
621 Western Ave.	2019 CalARP Seismic Assessment		Larry Peter -owner		
Petaluma, CA 94952	2015 Hazard Review - PHA		George Bennett MPE Services (951) 735-4418 gerorgeb@mpeservicesinc.com		
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2015 Priority Rank is based on What-If Recommendations and Action Plan

MP=maintenance program
PM=preventative maintenance
MIA=Mechanical Integrity Audit

Column 'D' - repeat/similar items	
1=Supports/ anchors/braces	4=Testing
2=Maintenance	5=Good Practice
3= Code compliance	6=Training

ITEM	DESCRIPTION	Recommendations	Column 'D' Repeat / similar Items	SOURCE	SOURCE REF. # / ID	Area/Equip. ID	PRIORITY RANK (CRITICAL=1 or A, URGENT=2 or B, IMPROVEMENT=3 or C, NON-URGENT=4 or D, GOOD PRACTICE=5 or E...)	DUE DATE	BLDG. PERMIT REQUIRED (Y/N)	BLDG. PERMIT #	BLDG. PERMIT DATE	INSTALLING CONTRACTOR INFORMATION (NAME, PHONE)	INSPECTION DATE(S) AND INSPECTOR	NON-BLDG. PERMIT VERIFIED BY AND DATE; NOTES	SPECIAL INSPECTION REQUIRED? (Y/N) E.G., ANCHORS	FIRE DEPT. OPERATIONAL PERMIT & INSPECTION REQUIRED (Y/N)
1	Anchor bolt corrosion	Clean or replace	1	2019 CalARP Seismic Assessment	1	High Pressure Receiver, Suction Accumulator, Glycol Chiller	3		Y							Y
2	Missing anchor bolts	Install Bolts	1	2019 CalARP Seismic Assessment	2	Liquid Transfer Pump	2		Y							Y
3	Loose anchor nuts and missing sway braces	Tighten anchors and install sway braces	1	2019 CalARP Seismic Assessment	3	Evaporator EV1	1		Y							Y
4	Missing sway braces	Install sway braces	1	2019 CalARP Seismic Assessment	4	Cold Box piping	2		Y							Y
5	Detached support	Reattach	1	2019 CalARP Seismic Assessment	5	RV Main Piping on Roof	3		Y							Y
6	Possible missing anchorage of tanks	Verify how the tanks are anchored, install anchors if needed	1	2019 CalARP Seismic Assessment	6	Ice Builders, Diffusion Tanks	2		Y							Y
7	Loose pipe strap	Reinstall pipe strap	1	2019 CalARP Seismic Assessment	7	RV pipe with Ice Builder 1 Surge Drum 2	3		Y							Y
8	Missing sway bracing	Install sway braces	1	2019 CalARP Seismic Assessment	8	Compressors 1-2 LIC	2		Y							Y
9	Supports >7'	Add supports at 7' spacing	1	2019 CalARP Seismic Assessment	9	Fire Diffusion Box	1		Y							Y
10	Pipe not rigidly supported	Secure pipe to HSD or CD pipe	1	2019 CalARP Seismic Assessment	10	Machinery Room Roof	3		Y							Y
11	Not functioning	Fix or replace	2	2020 PHA	1	Auto Purger	3	3/1/2021	N							Y
12	Non-labeled/marked ammonia equipment and piping	Install labels and marking	3	2020 PHA	2	General	3	3/1/2021	Y							Y
13	No temperature monitoring	Install temperature probes	3	2020 PHA	3	Surge Drums	3	3/1/2022	Y							Y
14	No insulation	Insulate	2	2020 PHA	4	Ice Builder 1 - Surge Drum	2	3/1/2021	N							Y
15	Name plates are not visible	Uncover/expose name plates and record information	2	2020 PHA	5	Ice Builder 2 - Surge Drums 1 and 2	3	3/1/2021	N							Y
16	No protection from vehicle/forklift	Install bollards/barriers	3	2020 PHA	6	Glycol Plate and Frame heat Exchanger	3	3/1/2021	Y							Y
17	Extensive corrosion - tank may be inoperative	Remove tank	2	2020 PHA	7	Ice Builder 1	2	3/1/2021	Y							Y
18	2018 is the last high level float switch test	Test high level float switch and repeat annually	4	2020 PHA	8	Suction Accumulator	2	9/1/2020	N							Y
19	Inadequate insulation	reinsulate with listed insulation	2	2020 PHA	9	Suction Accumulator	1	9/1/2020	N							Y
20	Name plate is not legible	Clean name plate and record information	2	2020 PHA	10	Suction Accumulator	3	3/1/2021	N							Y
21	No recent tests of cutouts	Perform test, and repeat annually	4	2020 PHA	11	Screw Compressors	2	9/1/2020	N							Y
22	No Oil analysis available		2	2020 PHA	12	Screw Compressors	3	3/1/2021	N							Y
23	No mechanical integrity program	Develop mechanical integrity program	2	2020 PHA	13	Evaporator Condenser	3	3/1/2021	N							Y
24	No fixed access to evaporative condenser	Install ladder	3	2020 PHA	14	Evaporator Condenser	2	9/1/2021	Y							Y
25	Unprotected/painted piping, valves, equipment	Clean and paint	2	2020 PHA	15	Exterior Piping, Valves, and Equipment	2	3/1/2021	N							Y

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26	Over tightening of valves - No contractor qualification packet	Obtain contractor qualification packet	2	2020 PHA	16	Valves	3	9/1/2020	N							Y
27	Deficient relief system	Upsize the relief system	3	2020 PHA	17	Relief Valves	3	3/1/2021	Y							Y
28	Blockage of E-Stop and Emergency Buttons	Relocate to Machinery Room entrance door	3	2020 PHA	18	Emergency Ventilation	3	3/1/2021	Y							Y
29	No recent testing	Test and repeat annually	4	2020 PHA	19	Emergency Stop Switch	3	9/1/2020	N							Y
30	Uncalibrated or nonfunctioning	Trouble shoot and repair/replace	3	2020 PHA	20	Ammonia Detection System	1	9/1/2020	Y							Y
31	Evacuation maps are not posted	Post evacuation maps	3	2020 PHA	21	Emergency Situation	3	9/1/2020	Y							Y
32	Water valve off	lock valve in open position	5	2020 PHA	22	Eye Wash Station	2	9/1/2020	N							Y
33	Exposed wires and extension cords run to air-cooling evaporators	Cover wires and install permanent wiring to air-cooling evaporators	3	2020 PHA	23	Global System Factors	3	9/1/2020	N							Y
34	Develop "Alarm and Control Strategy" for detection and responses	Test high-level float switches	4	2015 PHA	2	Screw Compressors	1	12/31/2015	N							Y
35	Ammonia vapor release	Establish a PM schedule for ammonia detector sensors	2	2015 PHA	22	Screw Compressors	3	6/20/2015	N							Y
36	Corrosion/vibration/impact failure of seal/bearing/ etc.	Include manufacturer recommendation testing in the MP	2	2015 PHA	23	Screw Compressors	3	6/30/2015	N							Y
37	Corrosion/vibration/impact failure of seal/bearing/ etc.	Include manufacturer recommendation oil testing in the MP	2	2015 PHA	24	Screw Compressors	4	6/30/2015	N							Y
38	Closed valves	Include P&ID valve references in startup SOP	3	2015 PHA	25	Screw Compressors	4	8/31/2015	N							Y
39	Suction valve is inadvertently closed	Implement PM for annual inspection of safety switches	3	2015 PHA	8	Screw Compressors	5	5/29/2015	N							Y
40	Suction valve is inadvertently closed	Review of SOP and P&ID with contractor-technician	5	2015 PHA	15	Screw Compressors	3	5/29/2015	N							Y
41	Liquid in suction line from accumulator	Utilize current program maintenance logs to document completion of PMs .	3	2015 PHA	20	Screw Compressors	2	5/29/2015	N							Y
42	Liquid in suction line from accumulator	Determine ammonia leak detector set points, label each detector with set point, and indicate on P&ID	3	2015 PHA	21	Screw Compressors	2	6/30/2015	N							Y
43	Oil coalescer fails	Implement PM to check pressure differential across coalescer for indication of change-out	2	2015 PHA	26	Screw Compressors	5	6/30/2015	N							Y
44	The capacity load system malfunctions	Ensure manufacturers recommendations for compressor PM activities and frequency are included in maintenance program	5	2015 PHA	9	Screw Compressors	6	5/29/2015	N							Y
45	PRV fails or is incorrectly set	Replace all PRV older than 5 years	3	2015 PHA	28	Screw Compressors	1	6/30/2015	Y							Y
46	PRV fails	Refresh employee emergency training.	3	2015 PHA	29	Screw Compressors	1	4/30/2015	N							Y
47	PRV fails	Verify emergency evacuation alarm can be heard in all facility areas	3	2015 PHA	38	Screw Compressors	1	3/31/2015	N							Y
48	PRV fails	Schedule and conduct emergency evacuation drills	3	2015 PHA	39	Screw Compressors	1	4/30/2015	N							Y
49	Inlet/outlet valve to condenser is closed	Ensure all applicable SOP's have a provision to avoid trapping liquid	5	2015 PHA	10	Evaporator Condenser	3	8/31/2015	N							Y
50	Inlet/outlet valve to condenser is closed	Tag and install clamshell devices at inlet valves V1000 and V1003 and condenser valves V1005 and V1006 and locking valves open	5	2015 PHA	31	Evaporator Condenser	4	4/30/2015	N							Y
51	Condenser water not properly treated and/or the coils are not properly cleaned	Ensure manufacturers recommendations for compressor PM activities and frequency are included in maintenance program	2	2015 PHA	11	Evaporator Condenser	4	5/29/2015	N							Y
52	Condenser water not properly treated and/or the coils are not properly cleaned	Obtain and review all condenser water treatment reports for the last 12 months and correct and document any noted deficiencies	3	2015 PHA	36	Evaporator Condenser	4	4/30/2015	N							Y
53	Coils, valves or piping leak/rupture	Review requirements for Emergency Eyewash and Shower stations, ensure compliance	3	2015 PHA	12	Evaporator Condenser	1	5/29/2015	N							Y
54	Coils, valves or piping leak/rupture	Conduct a Mechanical Integrity Audit by a qualified refrigeration engineer	3	2015 PHA	32	Evaporator Condenser	1	5/29/2015	N							Y

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55	Coils, valves or piping leak/rupture	Epoxy paint condenser piping and replace severely corroded pipe	2	2015 PHA	33	Evaporator Condenser	1	8/31/2015	N							Y
56	Coils, valves or piping leak/rupture	Clean valves	2	2015 PHA	34	Evaporator Condenser	1	8/31/2015	N							Y
57	Coils, valves or piping leak/rupture	Conduct Seismic Assessment by qualified engineer	3	2015 PHA	35	Evaporator Condenser	1	5/29/2015	N							Y
58	Weather is hot and humid	Verify energy balance for the system (load calculations)	5	2015 PHA	65	Evaporator Condenser	5	9/30/2015	N							Y
59	PRV fails or is incorrectly set	Replace all PRV older than 5 years	3	2015 PHA	28	Evaporator Condenser	1	6/30/2015	Y							Y
60	PRV fails on condenser	Refresh employee emergency training.	3	2015 PHA	29	Evaporator Condenser	1	4/30/2015	N							Y
61	PRV fails on condenser	Verify emergency evacuation alarm can be heard in all facility areas	3	2015 PHA	38	Evaporator Condenser	1	3/31/2015	N							Y
62	PRV fails on condenser	Schedule and conduct emergency evacuation drills	3	2015 PHA	39	Evaporator Condenser	1	4/30/2015	N							Y
63	Vessel, piping, valve, instrumentation/sight glass leaks-ruptures	Obtain all ASME manufacturer data reports (U1-A) and certified drawings for system's pressure vessels	3	2015 PHA	7	Pressure Vessels	1	5/29/2015	N							Y
64	Vessel, piping, valve, instrumentation/sight glass leaks-ruptures	Remove insulation from Suction Accumulator SA1, inspect. Perform UT/NDT for recertification or replace	2	2015 PHA	40	Pressure Vessels	1	6/30/2015	N				10/9/20 Corbett			Y
65	Vessel, piping, valve, instrumentation/sight glass leaks-ruptures	Review forklift training. For PIT operators	6	2015 PHA	50	Pressure Vessels	1	8/31/2015	N							Y
66	Liquid ammonia is trapped between closed valves	Ensure all applicable SOP's have a provision to avoid trapping liquid	5	2015 PHA	10	Pressure Vessels	3	8/31/2015	N							Y
67	Liquid ammonia is trapped between closed valves	Tag number of turns OPEN on the surge drum hand expansion (metering) valves	5	2015 PHA	43	Pressure Vessels	3	5/29/2015	N							Y
68	Liquid ammonia is trapped between closed valves	Replace all PRV older than 5 years	3	2015 PHA	28	Pressure Vessels	1	6/30/2015	Y							Y
69	Liquid ammonia is trapped between closed valves	Refresh employee emergency training.	6	2015 PHA	29	Pressure Vessels	1	4/30/2015	N							Y
70	Liquid ammonia is trapped between closed valves	Verify emergency evacuation alarm can be heard in all facility areas	3	2015 PHA	38	Pressure Vessels	1	3/31/2015	N							Y
71	Liquid ammonia is trapped between closed valves	Schedule and conduct emergency evacuation drills	3	2015 PHA	39	Pressure Vessels	1	4/30/2015	N							Y
72	High level of ammonia in High Pressure Receiver	Update SOPs to include a contractor's presence during a charging operation	5	2015 PHA	3	Pressure Vessels	2	8/31/2015	N							Y
73	High level of ammonia in High Pressure Receiver	Update the SOPs to include a ammonia delivery checklist	5	2015 PHA	4	Pressure Vessels	2	8/31/2015	N							Y
74	Manual valve in wet suction header from air handlers/heat exchanges to the Suction Accumulator is closed	Tag suction valves for air handlers and heat exchangers - normally open (N.O.)	5	2015 PHA	67	Pressure Vessels	5	5/29/2015	N							Y
75	Ammonia leak at transfer pump	Clean, label, modify P&ID, and obtain pump manufacturers IOM manual. Epoxy paint piping. Replace corroded piping.	2	2015 PHA	42	Refrigerant Pump	4	4/30/2015	N							Y
76	Liquid ammonia trapped between valves V1066 and V1070	Review SOPs and P&ID with contractor and document the review	2	2015 PHA	15	Refrigerant Pump	3	8/31/2015	N							Y
77	PRV malfunction on glycol heat exchanger/ice builder	Replace all PRV older than 5 years	3	2015 PHA	28	Flooded Evaporators	1	6/30/2015	Y							Y
78	PRV malfunction on glycol heat exchanger/ice builder	Refresh employee emergency training.	6	2015 PHA	29	Flooded Evaporators	1	4/30/2015	N							Y
79	PRV malfunction on glycol heat exchanger/ice builder	Verify emergency evacuation alarm can be heard in all facility areas	3	2015 PHA	38	Flooded Evaporators	1	3/31/2015	N							Y
80	PRV malfunction on glycol heat exchanger/ice builder	Schedule and conduct emergency evacuation drills	3	2015 PHA	39	Flooded Evaporators	1	4/30/2015	N							Y
81	Heat exchanger/piping/valve leaks/ruptures	Remove insulation from surge drum SD1 at glycol heat exchanger HX1, inspect,. Perform UT/NDT for recert. Or replace	2	2015 PHA	47	Flooded Evaporators	1	6/30/2015	N							Y
82	Heat exchanger/piping/valve leaks/ruptures	Conduct a Mechanical Integrity Audit for surge drums, ice builders, and glycol heat exchanger by a qualified refrigeration engineer	2	2015 PHA	46	Flooded Evaporators	1	5/29/2015	N					Corbett 10/9/20; APCCO		Y
83	Heat exchanger/piping/valve leaks/ruptures	Remove insulation from glycol heat exchanger HX1, inspect,. Perform UT/NDT for recert. Or replace. Reinsulate	2	2015 PHA	48	Flooded Evaporators	1	6/30/2015	N					Corbett 10/9/20; APCCO		Y

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84	Liquid ammonia trapped between valves	Tag NORMALLY OPEN isolation valves at surge drum liquid lines	3	2015 PHA	49	Flooded Evaporators	5	5/29/2015	N							Y
85	Fan blade breaks/AHU leak	Conduct a Mechanical Integrity Audit by a qualified refrigeration engineer	3	2015 PHA	44	Air Handling units	3	5/29/2015	N					Corbett 10/9/20; APCCO		Y
86	Leak in AHU valves, coils, flanges, lines, etc.	Conduct a Mechanical Integrity Audit by a qualified refrigeration engineer	3	2015 PHA	44	Air Handling units	3	5/29/2015	N					Corbett 10/9/20; APCCO		Y
87	Leak in AHU valves, coils, flanges, lines, etc.	Establish monthly maintenance program to monitor and perform required PM activities	2	2015 PHA	68	Air Handling units	3	5/29/2015	N							Y
88	Liquid ammonia trapped between valves	Tag NORMALLY OPEN isolation valves at AHU's liquid lines	3	2015 PHA	45	Air Handling units	4	5/29/2015	N							Y
89	PRV malfunction on glycol heat exchanger/ice builder	Refresh employee emergency training.	6	2015 PHA	29	Air Handling units	1	4/30/2015	N							Y
90	PRV malfunction on glycol heat exchanger/ice builder	Verify emergency evacuation alarm can be heard in all facility areas	3	2015 PHA	38	Air Handling units	1	3/31/2015	N							Y
91	PRV malfunction on glycol heat exchanger/ice builder	Schedule and conduct emergency evacuation drills	3	2015 PHA	39	Air Handling units	1	4/30/2015	N							Y
92	Manual valve is not operated properly	Verify all valves in system are tagged properly and agree with P&ID	3	2015 PHA	58	Ammonia System Piping and Valves	3	5/29/2015	N							Y
93	Manual valve is not operated properly	Arrange a walkdown of the ammonia system by a qualified refrigeration contractor, update the P&ID, equipment identification, valve tags, and pipe labeling	3	2015 PHA	59	Ammonia System Piping and Valves	3	6/30/2015	N							Y
94	Manual valve is not operated properly	Affix pipe labels throughout the system	3	2015 PHA	64	Ammonia System Piping and Valves	3	9/30/2015	N							Y
95	Manual valve is not operated properly	Update the Block Flow Diagram	3	2015 PHA	62	Ammonia System Piping and Valves	3	6/30/2015	N							Y
96	Relief header not sized for discharge from pressure vessel	Obtain Relief system calculations based on the IRC Safety Tool and make changes to the relief system if needed	3	2015 PHA	54	Ammonia System Piping and Valves	3	7/30/2015	Y					Corbett 10/9/20 modifications necessary		Y
97	Piping/equipment vibrating/improperly supported	Conduct Seismic Assessment by qualified engineer	3	2015 PHA	35	Ammonia System Piping and Valves	1	5/29/2015	N					Corbett 10/09/20		Y
98	Improper vapor barrier/insulation installed	Conduct a Mechanical Integrity Audit for piping insulation by a qualified refrigeration engineer	3	2015 PHA	52	Ammonia System Piping and Valves	1	5/29/2015	N					Corbett 10/9/20; APCCO		Y
99	Hand valves left open/closed without cycling. Manual valve not operated properly	Implement a PM for exercising and servicing all hand and control valves	2	2015 PHA	17	Ammonia System Piping and Valves	1	5/29/2015	N							Y
100	Hand valves left open/closed without cycling. Manual valve not operated properly	Develop and implement use of IIAR B109 Annual Inspection checklists	3	2015 PHA	53	Ammonia System Piping and Valves	1	3/31/2015	N							Y
101	Rupture in line/valve/flange/over pressurization	Review forklift training. For PIT operators	6	2015 PHA	50	Ammonia System Piping and Valves	1	8/31/2015	N							Y
102	Rupture in line/valve/flange/over pressurization	Conduct a MIA for piping and valves	3	2015 PHA	51	Ammonia System Piping and Valves	1	5/29/2015	N					Corbett 10/9/20		Y
103	Valve is closed in the charging line during pumping from truck	Update SOPs to include a contractor's presence during a charging operation	5	2015 PHA	3	Ammonia Charging Operation	2	8/31/2015	N							Y
104	Too much/little ammonia is added to the system	Update the SOPs to include a ammonia delivery checklist	5	2015 PHA	4	Ammonia Charging Operation	2	8/31/2015	N							Y
105	Low purity ammonia delivery	Update the SOPs to include purity documentation and verification by the vendor that hoses and equipment have been inspected as required	5	2015 PHA	30	Ammonia Charging Operation	5	8/31/2015	N							Y
106	Charging valve left open/leaks in normal operation	Identify the charge valve on the P&ID and label the charge valve	3	2015 PHA	60	Ammonia Charging Operation	1	3/30/2015	N							Y
107	Charging valve left open/leaks in normal operation	Install a check valve at the charge valve	3	2015 PHA	61	Ammonia Charging Operation	1	8/31/2015	Y							Y
108	Oil drain valve left unattended/open when draining oil. Improper oil draining procedure traps ammonia	Install new ASME oil pot with self-closing valve and isolation valve at Suction Accumulator	2	2015 PHA	37	Oil Draining	2	9/30/2015	Y				10/9/20 Corbett			Y
109	Oil drain valve left unattended/open when draining oil	Review requirements for Emergency Eyewash and Shower stations, ensure compliance	3	2015 PHA	12	Oil Draining	1	5/29/2015	N							Y
110	Attempt to drain oil from High Pressure Receiver HPR1	Install signage at HPR drain valve to NOT drain oil from the receiver	2	2015 PHA	41	Oil Draining	3	4/30/2015	N							Y
111	Backpressure of Ammonia Diffusion Tanks affect the relief system	Obtain Relief system calculations based on the IRC Safety Tool and make changes to the relief system if needed	3	2015 PHA	54	Ammonia Diffusion System	3	7/30/2015	Y					Corbett 10/9/20; Modifications needed. Mulitple failures		Y
112	Insufficient water in diffusion tanks	Include a daily check of Diffusion tanks water level on the daily log	2	2015 PHA	18	Ammonia Diffusion System	5	5/29/2015	N							Y

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113	Valves are not accessible in an emergency/maintenance	Install chain operators on inaccessible valves required for emergency response	3	2015 PHA	5	Startup, Shutdown and Maintenance issues	5	8/31/2015	Y							Y
114	Equipment not accessible for maintenance/emergency operations	Identify those having authority to shut down system during an emergency	3	2015 PHA	63	Startup, Shutdown and Maintenance issues	5	4/30/2015	N							Y
115	An open discharge header during PRV replacement on dual-valve assembly discharges overpressure from another vessel	Ensure that SOP for pressure relief valve replacement includes option for open relief header	5	2015 PHA	6	Startup, Shutdown and Maintenance issues	4	8/31/2015	N							Y
116	Emergency shutdown system fails	Implement PM for verifying operation of emergency shutdown system	2	2015 PHA	19	Startup, Shutdown and Maintenance issues	4	5/29/2015	N							Y
117	Ventilation system in Refrigeration Room fails/inadequate	Conduct a MIA for ventilation of Refrigeration Room	3	2015 PHA	55	Startup, Shutdown and Maintenance issues	1	5/29/2015	N							Y
118	Ammonia detection fails/poorly calibrated	Develop "Alarm and Control Strategy" for detection and responses	3	2015 PHA	2	Startup, Shutdown and Maintenance issues	1	12/31/2015	N							Y
119	Ammonia detection fails/poorly calibrated	Schedule testing of detection system by manufactures' recommendations. Establish method of retaining results and resolving deficiencies	3	2015 PHA	56	Startup, Shutdown and Maintenance issues	1	6/30/2015	N							Y
120	Ammonia detection fails/poorly calibrated	Consider replacement of current detector (system) with fault signal capability	3	2015 PHA	57	Startup, Shutdown and Maintenance issues	1	6/30/2015	Y							Y
121	Not enough emergency shower-eyewash stations	Review requirements for Emergency Eyewash and Shower stations, ensure compliance	3	2015 PHA	12	Startup, Shutdown and Maintenance issues	1	5/29/2015	N							Y
122		Implement PM for verifying operation of emergency shutdown system	3	2015 PHA	19	Global and General Facility Sitting issues	4	5/29/2015	N							Y
123	Ventilation system in Refrigeration Room fails/inadequate	Conduct a MIA for ventilation of Refrigeration Room	3	2015 PHA	55	Global and General Facility Sitting issues	1	5/29/2015	N							Y
124	Develop "Alarm and Control Strategy" for detection and responses	Test high-level float switches	4	2015 PHA	2	Global and General Facility Sitting issues	1	12/31/2015	N							Y
125	Ammonia detection fails/poorly calibrated	Schedule testing of detection system by manufactures' recommendations. Establish method of retaining results and resolving deficiencies	3	2015 PHA	56	Global and General Facility Sitting issues	1	6/30/2015	N							Y
126	Ammonia detection fails/poorly calibrated	Consider replacement of current detector (system) with fault signal capability	3	2015 PHA	57	Global and General Facility Sitting issues	1	6/30/2015	Y							Y
127	Defective defrost gauge on chiller	Replace the gauge	3	2019 MIA	1	Global and General Facility Sitting issues	1		N							Y
128	No oil pots installed at SA-1 and HX-1	Install oil pots to drain oil	2	2019 MIA	2	Global and General Facility Sitting issues	3		Y							Y
129	No Refrigeration sign that includes the name, address of the installing/service contractor. The approximate amount of ammonia, the lubricant and amount, and the test pressure.	Include all this on a sign near the house system pressure gages near the main door into the compressor room.	5	2019 MIA	3	Global and General Facility Sitting issues	2		N							Y
130	No emergency evacuation sign posted in the area of the compressor room.	Post evacuation sign.	3	2019 MIA	4	Global and General Facility Sitting issues	1		Y							Y
131	Aisle are not marked	Need to paint lines on the machinery room floor indicating aisle ways incase of poor visibility conditions.	3	2019 MIA	5	Global and General Facility Sitting issues	1		Y							Y
132	There is to be an eyewash/shower located with in 10 seconds of a hazardous material.	Install an eyewash/shower inside and outside near the doorway of the compressor room.	3	2019 MIA	6	Global and General Facility Sitting issues	1		Y					Corbett 10/9/20; Needs floor striping and signs		Y
134	In the main doorway the HPL piping extending slightly into the opening. The exits are to be clear of obstructions.	There is a metal guard. Need to paint it in a bright color to make visible.	3	2019 MIA	7	Global and General Facility Sitting issues	1		N							Y
135	The door into the maintenance area is a sliding barn door type. Doors are to be tight fitting fire doors, self closing, opening outward.	Need to install an approved door to allow for proper escape and to keep the refrigerant from escaping to other parts of the building.	3	2019 MIA	8	Global and General Facility Sitting issues	2		Y				Corbett 10/9/20; panic bar & swing door installed			Y
136	Electrical covers missing on Compressor 1 and HEX	Install covers on the electrical junction boxes.	3	2019 MIA	9	Global and General Facility Sitting issues	1		N							Y
137	There was an electrical control box found open in the compressor room. (See Figure 1)	Make sure that the electrical boxes are kept closed.	3	2019 MIA	10	Global and General Facility Sitting issues	1		N					Corbett 10/9/20 Doors closed		Y
138	Maintenance and oil log are needed for records of system operation.	Create a log and keep it up to date indicating the operating pressures, temperatures, refrigerant levels and the amount of oil added and removed to the system.	2	2019 MIA	11	Global and General Facility Sitting issues	3		N							Y
139	Cannot access relief valves that are up on top of the HSD piping at the condenser.	They can be removed from the condenser as it is not rated as ASME. Ensure that SOP's are written so as not to close the shut off valves condenser when it is full of liquid.	3	2019 MIA	12	Evaporator Condenser	3		Y							Y
140	There is no permanent access to the top of the coils for service. Could not check the condition of the condenser coil and mist nozzles for proper operation.	Need to examine the coil condition for corrosion.	3	2019 MIA	13	Evaporator Condenser	2		N							Y
141	The are not any identifying labels.	Label properly per IIAR 114.	3	2019 MIA	14	Evaporator Condenser	3		N							Y
142	There is slight visible corrosion on the condenser valves.	Prepare surface and paint.	2	2019 MIA	15	Evaporator Condenser	3		N					Corbett 10/9/20; pipe & valves painted		Y

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143	The condenser fan belts had an elevated noise level.	Check condenser belts for wear. Replace as needed.	2	2019 MIA	16	Evaporator Condenser	3		N							Y
144	Was not in service at the time of the walk through. Guards protecting moving parts are not installed.	Ensure that guard on drive coupling is installed prior to start-up of the compressor.	2	2019 MIA	17	Screw Compressors	1		N					Corbett 10/9/20; guard is installed		Y
145	Electrical covers missing on Compressor junction boxes. (See Figure 2 and 3)	Install covers on the electrical junction boxes.	3	2019 MIA	18	Screw Compressors	1		N							Y
146	Valve handles are missing. (See Figure 2)	Install missing handles.	3	2019 MIA	19	Screw Compressors	3		N							Y
147	Date sticker on PRV is missing. PRV may be out of time for the 5 year replacement.	Check records and determine when the last valve replacement was done. Update installation sticker.	3	2019 MIA	20	Screw Compressors	1		N							Y
148	There is rust on the compressor body. (See Figure 4)	Prepare surface and paint.	2	2019 MIA	21	Screw Compressors	2		N					Corbett 10/9/20		Y
149	Valve handles are missing. (See Figures 5 and 6)	Install missing handles.	3	2019 MIA	22	Screw Compressors	3		N					Corbett 10/9/20		Y
150	There are not any identification labels on the evaporators.	Label properly per IIAR 114.	3	2019 MIA	23	Evaporator EV1 and EV3	3		N							Y
151	Is not in use. Is still part of the system.	Recommend that it be cut out of the system.	2	2019 MIA	24	Ice Builder 1 - Surge Drum	3		Y							Y
152	No ID label.	Label properly per IIAR 114.	3	2019 MIA	25	Ice Builder 2 - Surge Drums 1 and 2	3		N							Y
153	Valves and surge drum are located less than 6 feet from the edge, no fall protection railing installed. (See Figure 7)	Install proper barrier on the edge of the roof of the ice builder or ensure that proper fall protection is worn by personnel working on top of the ice builder.	3	2019 MIA	26	Ice Builder 2 - Surge Drums 1 and 2	2		Y							Y
154	Piping has slight visible corrosion/rust. (See Figure 8)	Prepare surface and paint.	2	2019 MIA	27	Ice Builder 2 - Surge Drums 1 and 2	2		N							Y
155	Valves have slight visible corrosion. (See Figure 8)	Prepare surface and paint.	2	2019 MIA	28	Ice Builder 2 - Surge Drums 1 and 2	2		N							Y
156	Missing plug at oil drain location. (See Figure 9)	Need to install plug to keep refrigerant from leaking incase of inadvertent opening or valve failure.	2	2019 MIA	29	Glycol Plate and Frame heat Exchanger	2		N							Y
157	Insulation at heat exchanger is not sealed and piping has slight rust. (See Figure 10)	Repair insulation and clean and repaint pipe.	2	2019 MIA	30	Glycol Plate and Frame heat Exchanger	2		N							Y
158	Nameplate not readable. Cannot verify maximum allowable pressure so can not determine if relief valves are set at the correct pressure.	Need to find vessel information or replace the vessel.	3	2019 MIA	31	Pressure Vessels	1		N							Y
159	No ID label.	Label properly per IIAR 114.	3	2019 MIA	32	Pressure Vessels	3		N							Y
160	Extensive vapor retarder leaks. The type of insulation is not effective there ice and heavy corrosion on the vessel. (See Figure 11)	Replace the insulation with closed cell type with vapor barrier and jacket to keep the moisture out.	2	2019 MIA	33	Pressure Vessels	2		N							Y
161	The high level switch does not shut down the compressors.	Need to make it so that the compressors shut down on high level to prevent liquid slugging of the compressors and causing damage.	2	2019 MIA	34	Pressure Vessels	2		Y							Y
162	Valve handles are missing. (See Figure 12)	Install missing handles.	3	2019 MIA	35	Pressure Vessels	3		N					Corbett 10/9/20; Service wrench is needed		Y
163	The solenoid coil is missing a cap. (See Figure 13)	Replace the cap.	2	2019 MIA	36	Pressure Vessels	2		N							Y
164	There is slight visible corrosion/rust on the vessel. (See Figure 14)	Prepare surface and paint.	2	2019 MIA	37	Pressure Vessels	2		N							Y
165	There is not an Identification label.	Label properly per IIAR 114.	3	2019 MIA	38	Pressure Vessels	3		N							Y
166	ID label does not have a green "Low Pressure" section on the label.	Label properly per IIAR 114.	3	2019 MIA	39	Pressure Vessels	3		N							Y
167	The insulation is damaged. (See Figure 15)	Repair insulation as needed	2	2019 MIA	40	Pressure Vessels	3		N							Y
168	Rust on equipment and valve handles are missing. (See Figures 16 and 17)	Install missing handles.	3	2019 MIA	41	Pressure Vessels	3		N							Y
169	Relief valve has slight external corrosion.	Make sure that the relief valves are changed out every 5 years or per manufacturers instructions.	3	2019 MIA	42	Pressure Vessels	2		N							Y
170	No visible nameplate.	Need to locate the nameplate under the insulation. Need to know what the pressure set point is for relief valves.	3	2019 MIA	43	Pressure Vessels	1		N							Y
171	No ID label.	Label properly per IIAR 114.	3	2019 MIA	44	Pressure Vessels	3		N							Y

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172	Relief valve has slight external corrosion.	Make sure that the relief valves are changed out every 5 years or per manufacturers instructions.	3	2019 MIA	45	Pressure Vessels	3		N							Y
173	The equipment is not in use.	Should be locked out and pumped down for removal or replacement as maintenance is still required..	2	2019 MIA	46	Pressure Vessels	3		Y							Y
174	No ID label. (See Figure 8)	Label properly per IIAR 114.	3	2019 MIA	47	Pressure Vessels	3		N							Y
175	There is extensive corrosion the vessel. (See Figure 8)	Need to clean vessel re-paint and insulate the vessel.	2	2019 MIA	48	Pressure Vessels	3		N							Y
176	Relief valve has slight external corrosion.	Label properly per IIAR 114.	3	2019 MIA	49	Pressure Vessels	3		N							Y
177	Auto-Purger is not in operation. Had error code shown on control panel.	Trouble shoot and repair as needed.	2	2019 MIA	50	Auto Purger	2		N							Y
178	The tank used as a diffusion tank is an old milk tank and does not meet the requirements of the code for design of height being at the least twice the diameter in length. The tank is just 8' tall and 12' Diameter.	Need to install a tank built to the design requirements for ammonia.	3	2019 MIA	51	Ammonia Diffusion System	2		Y							Y
179	The tank was filled with milk water. This may not mix as needed with the ammonia.	Remove the cow water and install clean water in the tank so that the ammonia can be absorbed properly.	3	2019 MIA	52	Ammonia Diffusion System	2		N							Y
180	No pump nameplate and guard on coupling.	Install guards and nameplate	2	2019 MIA	53	Liquid Transfer Pump	1		N					Corbett 10/9/20		Y
181	No minimum flow by pass valve.	Install by pass valve	2	2019 MIA	54	Liquid Transfer Pump	1		Y							Y
182	No cross bracing for seismic requirements. (See Figure 19)	Install cross bracing to keep pipe from lateral movement.	3	2019 MIA	55	Ammonia System Piping and Valves	2		Y							Y
183	Most of the piping does not have labels. (See Figure 20)	Label properly per IIAR 114, at changes in direction and 40 ft apart.	3	2019 MIA	56	Ammonia System Piping and Valves	3		N							Y
184	Slight vapor retarder leaks on the insulation.	Repair / Replace insulation as needed.	2	2019 MIA	57	Ammonia System Piping and Valves	2		N							Y
185	Extensive corrosion/pitting on piping to evaporators. (See Figure 21)	Recommend replacing the pipe to the evaporators outside between the buildings.	3	2019 MIA	58	Ammonia System Piping and Valves	1		N							Y
186	Slight corrosion/rust on piping through out the plant. (See Figures 22, 23, 24, 25, 26)	Prepare surface and paint.	2	2019 MIA	59	Ammonia System Piping and Valves	2		N							Y
187	Need more support for piping to the emergency control box.	Install supports to prevent vibration.	3	2019 MIA	60	Ammonia System Piping and Valves	2		Y							Y
188	There is movement on the liquid line to the chiller skid.	Need to install additional supports to prevent piping from moving.	3	2019 MIA	61	Ammonia System Piping and Valves	2		Y							Y
189	In the compressor room there is a weld that did not have the final root pass made. Otherwise is appears that there is metal loss. (See Figure 27)	Have weld completed.	2	2019 MIA	62	RV Piping	2		N					Corbett 10/9/20; Pipe removed for install of new Suction Accumulator		Y
190	The relief piping calculations show that some of the piping is undersized. This could be reduced if some of the PRV's are replaced with smaller capacity valves at the 5 year change out.	Consider replacing the relief valves and upsizing the relief piping.	3	2019 MIA	63	RV Piping	3		Y							Y
191	There is a broken gauge.	Replace the gauge.	2	2019 MIA	64	Fire Diffusion Box	1		N							Y
192	No emergency contacts inside.	Create a list of the emergency names and phone numbers and locate inside the box.	3	2019 MIA	65	Fire Diffusion Box	1		N							Y
193	No operating instructions inside.	Create SOP's for the operation of the control box valves and locate inside the box.	3	2019 MIA	66	Fire Diffusion Box	2		N					Corbett 10/9/20; Instructions inside door		Y
194	The fan control switch is located inside the system control box located in the compressor room.	There is to be an emergency fan control switch located outside of the main compressor room door.	3	2019 MIA	67	Emergency Ventilation	2		Y							Y
195	Continuous fan. Intake is from the doors only. No control switch. The sliding door pulls into the room when the fan is in operation.	There should be an opening from the outside for supply air.	3	2019 MIA	68	Emergency Ventilation	2		Y							Y
196	The ammonia sensors are to be calibrated and tested per the manufactures instructions. Usually on a semi-annual basis. The test gas found on site is pass the due date by many years. (See Figure 28)	Need to get a current Test Kit and have testing performed as required.	2	2019 MIA	69	Ammonia Detection System	1		N							Y
197	E-Stop is located at control panel inside the compressor room.	E-stops are to be located next to the main entry way door. Need to install proper E-Stops outside the exit doors.	3	2019 MIA	70	EPO Button	2		Y							Y
198	Does not have manual reset.	Make to have manual reset incase of system upset.	5	2019 MIA	71	High Level Safety Testing GC1	2		Y							Y
199	The switch does not shut down the compressors.	This should be made to protect the compressors from high level and liquid carry over.	3	2019 MIA	72	High Level Safety Testing SA-1	2		N							Y
200	Does not shut down the King valve.	OK as HPL does not feed to SA-1	5	2019 MIA	72	High Level Safety Testing SA-1	2		N							Y

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201	Does not have manual reset.	Make to have manual reset incase of system upset.	5	2019 MIA	74	High Level Safety Testing SA-1	2		Y							Y
202	There is a valve from the HPR that is low to the ground and in the walking area. (See Figure 29)	Need to paint with bright color safety yellow and post sign for trip hazard.	3	2019 MIA	75	Global and General Facility Sitting issues	2		N							Y
203	P&ID were last revised in 2002. The name of the company needs to be changed. Equipment has been changed.	Need to update P&ID. (see the marked up drawings)	3	2019 MIA	76	Global and General Facility Sitting issues	3		N							Y
204	Determine ammonia leak detector set points, label each detector with set points and P&ID reference, and indicate on the P&IDs.		3			Ammonia Detection System	1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
205	Install signage required by CMC and CFC for contractor, emergency response, charge, oil type, etc. and "Ammonia Caution" signage at the machinery rooms.		3				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
206	Remove insulation from Surge Drum SD1 at Glycol Heat Exchanger HX1 and inspect for corrosion and/or other damage. Perform UT/NDT for recertification of the vessel or replace as required.		2				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
207	Remove insulation from Heat Exchanger HX1 and inspect for corrosion and/or other damage. Perform UT/NDT for recertification of the vessel or replace as required.		2				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
208	Remove insulation from suction accumulator SA1 and inspect for corrosion and/or damage. Perform UT/NDT for recertification of the vessel or replacement as required.		2				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
209	Install new ASME Oil Pot with self-closing spring-loaded valve and isolation valve at suction accumulator.		5				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
210	Provide pump down procedures, coordination, and service to pump down the ammonia into the high-pressure receiver and/or surge drum to allow demo of the existing suction accumulator.		5				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
211	Remove door into machine room and widen wall to facilitate removal and installation of suction accumulator.		5				3		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
212	Demo existing suction accumulator and haul away debris.		5				4		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
213	Furnish and install (1) 42" dia. X 6'6" OAL horizontal suction accumulator.		3				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981			y	Y
214	Furnish and install (1) 8" dia x 3'0" oil pot.		3				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
215	Nitrogen pressure test up to the tie-in points.		3				1		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981	10/9/2020	Corbett		Y
216	Furnish and install new insulation on the suction accumulator and piping up to the tie-in points. Insulation shall feature urethane material with Mylar vapor barrier and PVC jacketing.		5				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
217	Update P&ID's.		3				3		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
218	Re-install wall and door into machine room.		3				3		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
219	Tag & label new valves and piping.		3				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
220	Evacuate system and start-up the refrigeration system.		5				2		Y	BLDG-20-1390	Oct-20	APCCO - Aaron Heasell (707) 225-2981				Y
221	Wind Socks	Replace	2	10/9/20 Inspection												Y

Ammonia Refrigeration System
CalARP Seismic Assessment

For

PETALUMA CREAMERY
EST. 1913

621 Western Ave
Petaluma, CA 94952

Performed by:

RESOURCE COMPLIANCE

Table of Contents

Executive Summary

Resource Compliance, Inc. conducted an ***Initial*** *Seismic Assessment* of the ammonia refrigeration system at Petaluma Creamery, 621 Western Ave, Petaluma, CA 94952 on September 30, 2019.

The purpose of the *Seismic Assessment* was to:

1. Identify the system's conformance with accepted industry safety standards and governing codes related to seismic design and installation. Specifically, Resource Compliance analyzed the ammonia refrigeration system using the following standards which are widely accepted as *recognized and generally accepted good engineering practice (RAGAGEP)*:
    - ASCE/SEI 7-10 *Minimum Design Loads for Buildings and Other Structures*
    - *ASHRAE Practical Guide to Seismic Restraint*, Second Edition
2. Comply with the requirements of the following regulations and regulatory guidance documents:
    - Title 19 CCR, Chapter 4.5 §2755.2(d) *CalARP (Hazard Review Seismic Requirements)*
    - *Guidance For California Accidental Release Prevention (CalARP) Program Seismic Assessments*, December 2013 Edition

This report attempts to list deficiencies and recommend remediation in relative order of priority; however, all safety and regulatory compliance issues should be addressed within a reasonable period of time.

In general, a ***reasonable*** amount of improvement is required to correct seismic deficiencies affecting the ammonia refrigeration system and thus become compliant with recognized industry safety standards and codes. For the most part, equipment is anchored, and piping is securely fastened to supports. The Liquid Transfer Pump anchorage, Evaporator EV1 supports, and trapeze pipe supports in the Cold Box require ***significant*** improvement.

Relative to accepted good industry standards and overall code compliance, the refrigeration system at Petaluma Creamery can be improved with implementation of the recommendations contained in this report.

Note: The *Seismic Assessment* referred to herein was conducted using P&IDs that were revised on 11/20/2002 by APCCO. References to specific pieces of equipment in this report refer to equipment identified on these P&IDs.

Facilities

Petaluma Creamery operates a cheese/butter processing facility in Petaluma, CA. The facility has an ammonia refrigeration system that provides refrigeration capacity to the following:

- (1) Cold Box
- (1) Glycol Chiller
- (2) Ice Builders

The refrigeration system is equipped with evaporators and surge drums as required for flooded or direct expansion operation. A partial list of system components includes:

Machinery Room

- (2) Screw compressors
- (1) Suction accumulator

- (1) Liquid transfer vessel and pump
- (1) High pressure receiver
- (1) Emergency control box
- (1) Auto-purger

Machinery Room Roof

- (1) Evaporative condenser

Ice Builder Area

- (2) Ice builders
- (1) Glycol chiller

Cold Box

- (2) Air-cooling evaporators (ceiling-suspended)

Diffusion Tank Area

- (2) Diffusion Tanks
- (1) Fire Diffusion Box

1. Soil Profile and Site Classification

The Soil Site Classification for Petaluma Creamery was determined by using the United States Geological Survey (USGS) VS30 Web Application. Using topographic slope, this application showed that the shear wave velocity for the soil at the facility is approximately 407 m/s (1,335 ft/s) for VS30, the time-averaged shear-wave velocity to 30m depth. With regards to this shear wave velocity, the Site Classification table 20.3-1 from ASCE 7-2016 was used to determine a Soil Site Class of C, or "Very dense soil and soft rock," for Petaluma Creamery.

2. Determination of Seismic Hazards

Per the *Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments* the following site-specific hazards were considered:

- Ground shaking
- Fault rupture
- Liquefaction
- Seismic settlement
- Landslides
- Tsunamis and seiches

2.1. Ground Shaking

Utilizing the Peak Ground Acceleration (PGA) information from the California Geological Survey (CGS), it was determined that the PGA at the site is 0.789g for VS30 = 407 m/s. We recommend that this number be used as the basis for the PGA at this site. Ground shaking was also analyzed using U.S. Seismic Design Maps and ASCE/SEI 7-10.

2.2. Fault Rupture

Petaluma Creamery is not located in an Alquist-Priolo Fault Zone as defined by the California Department of Conservation. In addition, a review of United States Geological Survey (USGS) fault maps showed that faults within close proximity are not considered high risk:

- Concord Fault - <150 Years
- Hayward Fault Zone - <150 Years
- San Andreas Fault Zone - <150 Years
- Pleasanton Fault - < 15,000 Years
- Collayomi Fault Zone - <130,000 Years

With regard to the known USGS faults, the threat of fault rupture is low. The most significant earthquake that occurred near the site in the last five (5) years was The Geysers earthquake on December 14, 2016, which resulted in a magnitude 5.01 quake at distance of 42 miles from the site. The above-named earthquake did not result in damage at the site. A map and table of earthquakes with magnitude 3.0 or greater within 100km of the site has been prepared. In addition, the location of fault zones in the vicinity of sites has been prepared.

The USGS 2018 One-Year Model revealed that Petaluma Creamery had a 2-5% chance of experiencing "potentially minor-damage" due to ground shaking in 2018.

2.3. Liquefaction and Lateral Spreading

Liquefaction is the transformation of soil from solid to a liquid state caused by an increase in pore water pressure and a reduction of effective stress within the soil mass. The potential for liquefaction is greatest when loose saturated sandy soils or silty soils of low plasticity are subjected to a long duration of seismically induced strong ground shaking. According to the CGS Seismic Hazard Zone Maps and USGS data liquefaction is not likely to occur at or near Petaluma Creamery.

2.4. Seismic Settlement

A soil report was not available, so the likelihood of seismic settlement was not determined. However, USGS and CGS data did not produce any known cases of seismic settlement on or near the site.

2.5. Landslides

The landslide potential was determined to be low because there are no existing slopes (natural or man-made) in the immediate vicinity of the facility.

2.6. Tsunamis and Seiches

Tsunamis, or tidal waves, are generated by distant earthquakes and undersea fault movement. Traveling through the deep ocean, a tsunami is a broad and shallow, but fast moving, wave that poses little danger to most vessels. When it reaches the coastline however, the waveform pushes upward from the ocean bottom to make a swell of water that breaks and washes inland with great force.

A seiche occurs when resonant wave oscillations form in an enclosed or semi-enclosed body of water such as a lake or bay. Seiches may be triggered by moderate or larger local submarine earthquakes and sometimes by large distant earthquakes.

Petaluma Creamery is located approximately 12 miles from San Pablo Bay and 14 miles from Tomales Bay. Therefore, it is unlikely to be affected by a title tsunami or seiche.

3. Engineering Assessment

The seismic walkdown was performed on September 30, 2019, by Peter Thomas, P.E., the President and Senior Engineer at Resource Compliance. Peter has extensive knowledge of chemical safety regulations with particular emphasis on ammonia refrigeration and process safety management. He has a degree in mechanical engineering from California Polytechnic State University San Luis Obispo and is a licensed professional engineer.

A summary of the walkdown findings is included below:

3.1. Inspection of Equipment Supports

Most ammonia refrigeration equipment is properly anchored in accordance with ASCE/SEI 7-2010 §13.4. Notable exceptions of equipment not properly anchored include the Liquid Transfer Pump and Evaporator EV1. The Liquid Transfer Pump anchor nuts are missing entirely and Evaporator EV1 supporting rods are bent and have multiple loose nuts. It is unknown if the Ice Builders are anchored to the concrete as no anchor nuts/bolts were visible. Similarly, it could not be confirmed if the Diffusion Tanks are anchored to the concrete. The Diffusion Tanks are configured with short pipe stubs which rest on the bottom of the tanks, but it is unclear if the pipes are embedded into the concrete beneath.

3.2. Inspection of Piping Hangers and Supports

In several areas pipe supports are lacking and in violation of ANSI/IIAR 2-2014 §13.4. In particular the following areas pose concerns:

- Cold Box trapeze pipe supports are not equipped with sway bracing;
- Compressors 1-2 LIC pipes are supported by all-thread supported with J-hangers. The supports have noticeable movement and Compressor 2 LIC pipe is suspended above the J-hanger;
- 1" piping to the Fire Diffusion Box is not supported at the correct frequency; and
- ½" FG piping on the roof is not rigidly supported.

3.3. Pipe and Equipment Accessibility

Safe access to and emergency egress from the valves and equipment at Petaluma Creamery is provided consistent with the requirements of ANSI/IIAR 2-2014 §5.12.1.

Summary

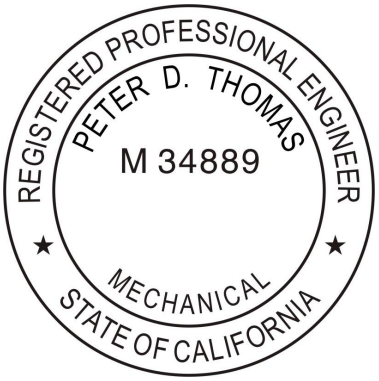
Overall, relative to generally accepted good industry standards, safe practices, and compliance with codes having jurisdiction at Petaluma Creamery, the ammonia refrigeration equipment at this facility is in *average* seismic condition.

It is economically feasible to bring this facility up to *good* standards by acting on recommended safety and operability remediation in this report.

Remediation recommended in this report can be completed in a reasonable period of time to minimize financial impact without sacrificing safety of personnel.

Resource Compliance assumes no responsibility for the implementation of recommended corrective measures. No attempt was made during the Seismic Assessment to identify all hazards.

Resource Compliance does not warrant that requirement of any Federal, State, or local law, regulation or ordinance have or have not been met.



Peter Thomas, P.E.

President

Resource Compliance, Inc.

CalARP Seismic Assessment Action Plan

California Code of Regulations, Title 19, Division 2, Chapter 4.5 California Accidental Release Prevention (CalARP) Program, §2755.2 Hazard Review, requires that *The owner or operator shall document the results of the hazard review and ensure that problems identified are resolved. The owner or operator shall enter into an agreement with the AA on a timetable for resolution of these problems. Otherwise these resolutions shall be completed within two and one-half (2.5) years of performing the hazard review or the next planned turnaround for items requiring a turnaround. These timelines shall not apply to any hazard review completed prior to January 1, 2015. The final resolution taken to address the hazard review recommendation and the actual completion date shall be documented.* [§2755.2(e)]

Three levels of non-compliance are assigned throughout this action plan:

1. Priority
2. Regulatory / RAGAGEP
3. Operability

Priority ***1*** indicates that part(s) of the facility's regulatory compliance program or State Mechanical / Fire Codes (CMC / CFC) or a piece of equipment is in a state of gross noncompliance or is identified as an imminent safety hazard. Correction of any issue identified as ***1*** should be addressed before further use, or in a safe and timely manner provided means are taken to assure safe operation.

Regulatory / RAGAGEP ***2*** indicates that part(s) of the facility's regulatory compliance program or State Mechanical / Fire Codes (CMC / CFC) or a piece of equipment has been identified as being deficient, and if left uncorrected, could result in the facility being cited for willful noncompliance, or pose a safety risk to operating personnel. A ***2*** condition should be addressed in a timely manner.

Operability condition ***3*** indicates that part(s) of the facility's overall safety program or a piece of equipment is in need of attention to preserve the remaining integrity of a piece of equipment and or to improve safety, operability and maintenance.

The facility's management should monitor **all** corrective and or planned actions, until complete.

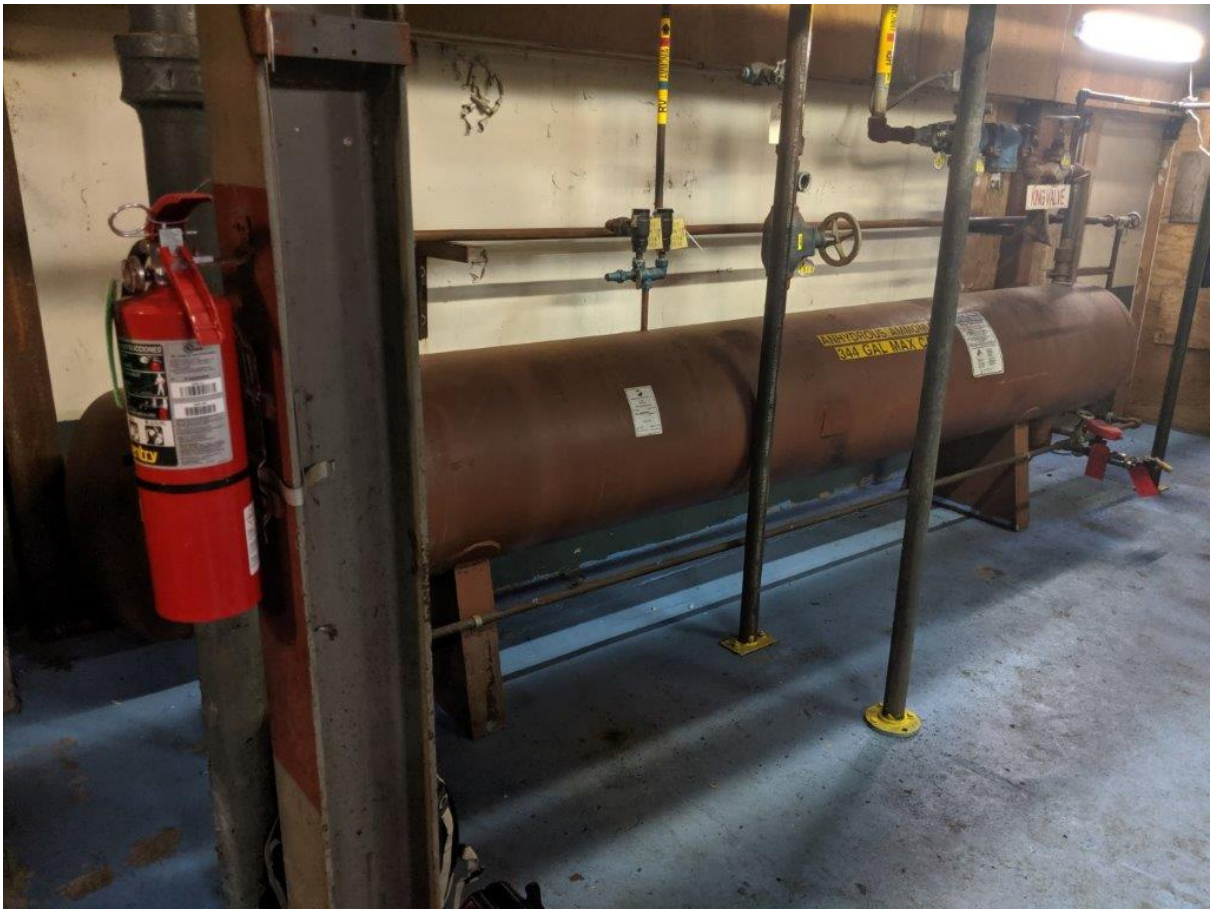
Item No.	Area Equip. ID	Key Findings / Recommendations	Priority Rating	Assigned To	Target Date	Completion Date	Corrective Actions
1	*High Pressure Receiver, Suction Accumulator, Glycol Chiller*	Numerous anchor nuts/bolts inspected were noted for having experienced moderate external corrosion: (1) High Pressure Receiver [Caption 2]; (2) Suction Accumulator [Caption 4]; (3) Glycol Chiller [Caption 30]. The condition of the nuts/bolts does not appear to be a seismic concern at this time, but if not addressed will eventually deteriorate and become a hazard. Ensure that the nuts/bolts are cleaned or replaced to prevent further deterioration. [ASHRAE Practical Guide to Seismic Restraint Second Edition Page 139, ASCE/SEI 7-2016 §13.4]	3				
2	*Liquid Transfer Pump*	The anchor nuts needed to fasten the Liquid Transfer Pump to the Liquid Transfer skid are missing [Caption 8, Caption 9]. ASHRAE Practical Guide to Seismic Restraint Second Edition Page 139 states that "*Equipment should be connected directly to the structure using a minimum of four fasteners*". Ensure that the Liquid Transfer Pump is anchored using the mounting holes provided on the unit. [2012 Practical Guide to Seismic Restraint Second Edition Page 139, ASCE/SEI 7-2016 §13.4, MSS-SP-58-2018 §14.2.7, ANSI/IIAR 6-2019 Table 6.1 Inspection Item S]	2				
3	*Evaporator EV1*	The condition of the Evaporator EV1 supports are a concern. Several anchor nuts are loose and one of the rear all-threads are bent [Caption 17, Caption 18]. Additionally, the unit is not configured with sway bracing to restrict lateral/longitudinal movement. It is recommended that the all nuts be properly tightened, bent all-thread replaced, and sway braces installed. [ASHRAE Practical Guide to Seismic Restraint Second Edition Page 131]	1				
4	*Cold Box Piping*	The pipes in the Cold Box are supported by trapeze pipe supports. The supports are not equipped with sway braces to restrict lateral or longitudinal movement [Caption 20]. In regard to sway bracing of suspended piping, ASHRAE Practical Guide to Seismic Restraint Second Edition Page 98 requires that "*each individual or trapeze-supported piping run should be sway braced to limit motion in all directions*." Additionally, the all-thread rods associated with one of the trapeze supports between Evaporators EV1 an EV2 are bend [Caption 22]. It is recommended that the bent rods be replaced, and sway bracing installed for expected seismic activity. [ASHRAE Practical Guide to Seismic Restraint Second Edition Page 98]	2				
5	*Piping*	A strut clamp used to fasten the RV main on the roof to a pipe support has become detached [Caption 25]. Ensure that the pipe is properly fastened to the pipe support. [ANSI/IIAR 6-2019 Appendix B Piping Checklist Item B]	3				
6	*Ice Builders, Diffusion Tanks*	It is unknown if the Ice Builders and Diffusion Tanks are anchored to the concrete foundation [Caption 31, Caption 34, Caption 41]. No anchors are visible on the Ice Builders and the Diffusion Tanks are	2				

Item No.	Area Equip. ID	Key Findings / Recommendations	Priority Rating	Assigned To	Target Date	Completion Date	Corrective Actions
		configured with short pipe stubs which rest on the bottom of the tanks, but it is unclear if the pipes are embedded into the concrete beneath. Ensure that the above-named equipment is properly anchored to the concrete foundation. [2012 Practical Guide to Seismic Restraint Second Edition Page 139, ASCE/SEI 7-2016 §13.4, MSS-SP-58-2018 §14.2.7, ANSI/IIAR 6-2019 Table 6.1 Inspection Item S]					
7	*Piping*	The RV pipe associated with Ice Builder 1 Surge Drum 2 is fastened to a roof using a pipe strap that is nailed to the roof joist. The nail does not appear to be fully engaged in the wood [Caption 36]. It is recommended that the pipe strap be reinstalled to avoid loosening over time. [ANSI/IIAR 6-2019 Appendix B Piping Checklist Item B]	3				
8	*Piping*	Compressors 1-2 LIC pipes are supported by all-thread supports equipped with J-hangers [Video 1, Caption 38, Caption 39]. The pipes can be easily moved with a gentle push and the Compressor 2 LIC pipe is suspended above the J-hanger, rendering the support ineffective. It is recommended that the LIC pipe supports be equipped with sway bracing and the Compressor 2 LIC J-hanger adjusted so that the pipe rests on the support. [ANSI/IIAR 6-2019 Table 11.1 Inspection Items D-G, ASME B31.5-2016 §521.1.3, ANSI/IIAR 2-2014 Addendum A Appendix F Table F.1]	2				
9	*Piping*	The 1" piping to the Fire Diffusion Box (FDB) is not supported at the correct frequency [Caption 42, Caption 43]. ANSI/IIAR 2-2014 Addendum A Appendix F Table F.1 recommends that 1" pipe be supported at intervals not exceeding 7', but the spans at Petaluma Creamery appear to exceed 15'. Ensure that the pipes are supported at the recommended frequency. [ANSI/IIAR 2-2014 Addendum A Appendix F]	1				
10	*Piping*	The FG piping on the machinery room roof is not rigidly supported [Video 2, Caption 23]. The pipe can be moved with a gentle push. It is recommended that the FG pipe be secured to the HSD or CD pipe running parallel to it to prevent movement. [ANSI/IIAR 2-2014 Addendum A §13.4]	3				

Collaborating Photographs

Collaborating Videos

- ***Video 1*** – Compressors 1-2 LIC Piping
- ***Video 2*** – Foul Gas Piping on the Roof

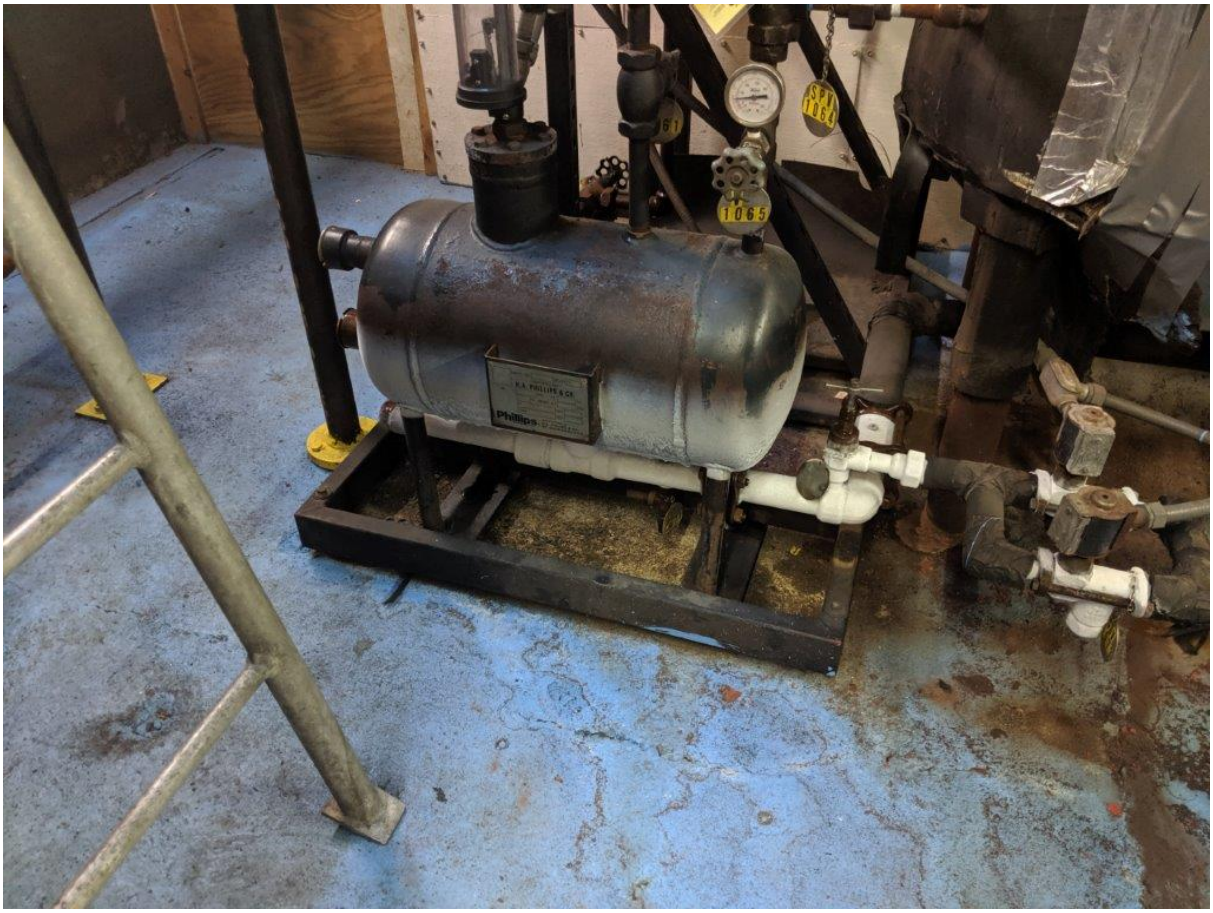


Caption 1. High Pressure Receiver

Caption 2. High Pressure Receiver Anchorage (Typical) [Action Item 1]

Caption 3. Suction Accumulator

Caption 4. Suction Accumulator Anchorage (Typical) [Action Item 1]

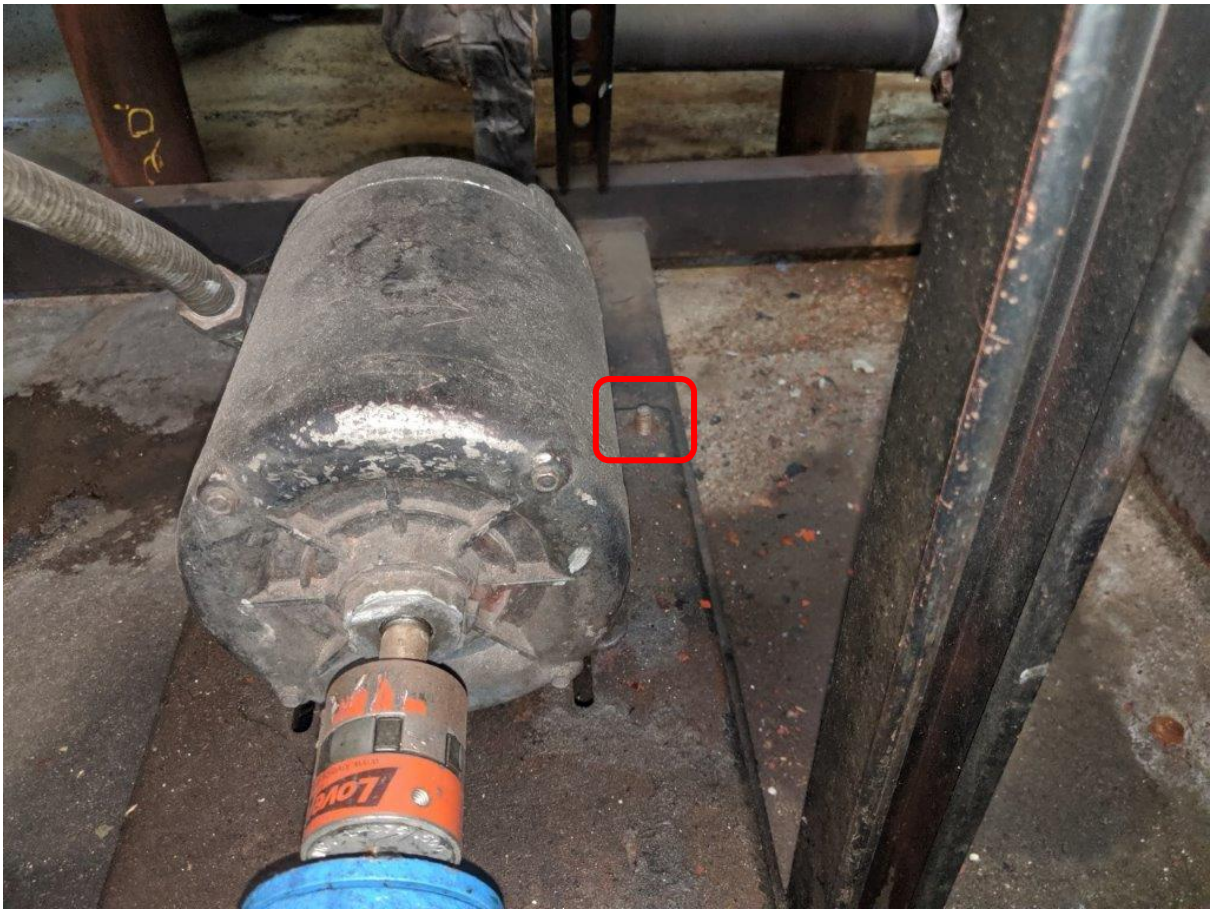


Caption 5. Liquid Transfer Vessel

Caption 6. Liquid Transfer Pump

Caption 7. Liquid Transfer Skid Anchorage (Typical)

Caption 8. Liquid Transfer Pump Anchorage [Action Item 2]



Caption 9. Liquid Transfer Pump Anchorage [Action Item 2]

Caption 10. Compressor 1

Caption 11. Compressor 1 Anchorage (Typical)

Caption 12. Compressor 2

Caption 13. Compressor 2 Anchorage (Typical)

Caption 14. Auto-Purger

Caption 15. Auto-Purger Fasteners

Caption 16. Evaporator EV1

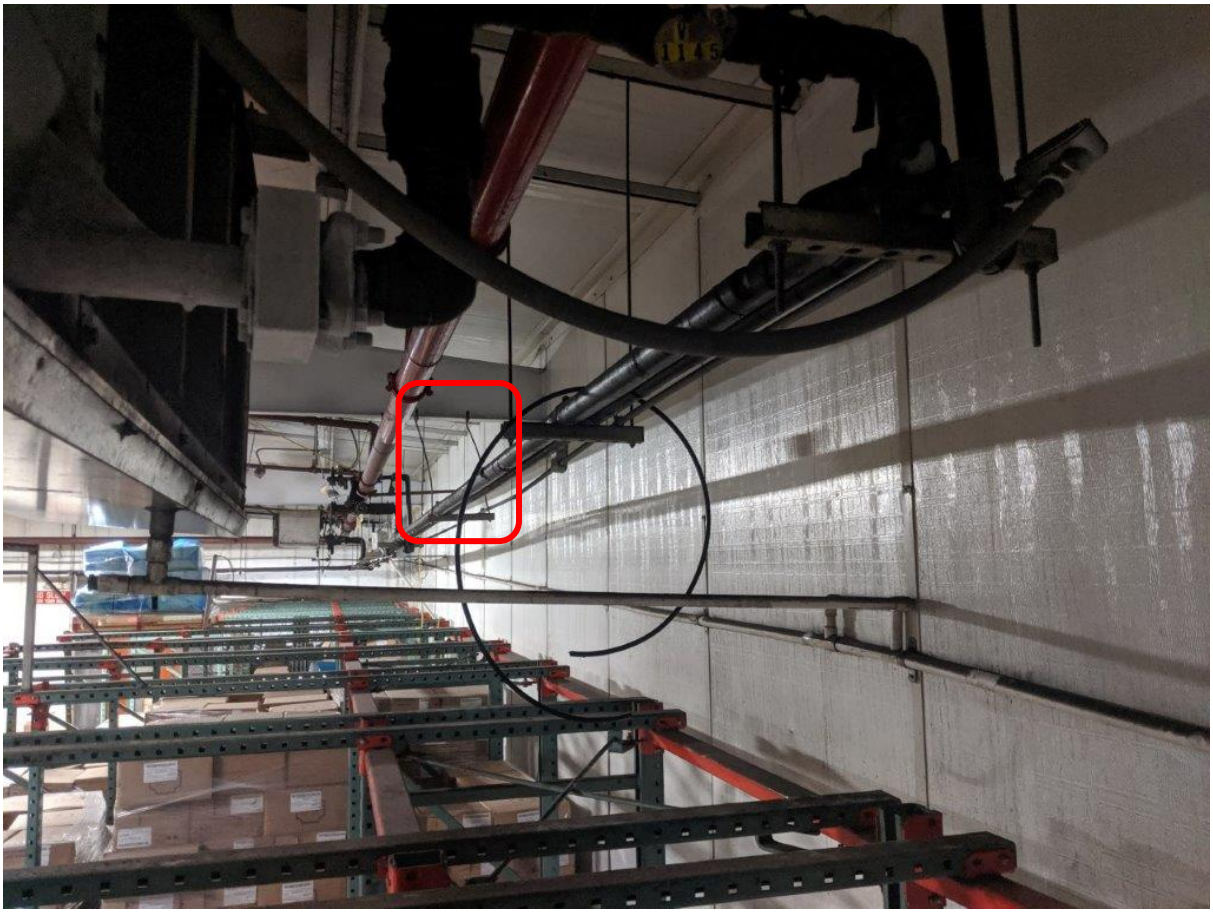
Caption 17. Evaporator EV1 Support Structure [Action Item 3]

Caption 18. Evaporator EV1 Support Structure [Action Item 3]

Caption 19. Evaporator EV2

Caption 20. Cold Box Piping [Action Item 4]

Caption 21. Evaporator EV2 Support Structure



Caption 22. Cold Box Piping [Action Item 4]

Caption 23. Roof Piping [Action Item 10]

Caption 24. Roof Piping

Caption 25. Roof Piping [Action Item 5]

Caption 26. Condenser

Caption 27. Condenser Anchorage (Typical)

Caption 28. Glycol Chiller Skid

Caption 29. Glycol Chiller Skid Anchorage (Typical)

Caption 30. Glycol Chiller Anchorage to Skid [Action Item 1]

Caption 31. Ice Builder 1 [Action Item 6]

Caption 32. Ice Builder 1 Surge Drum 1

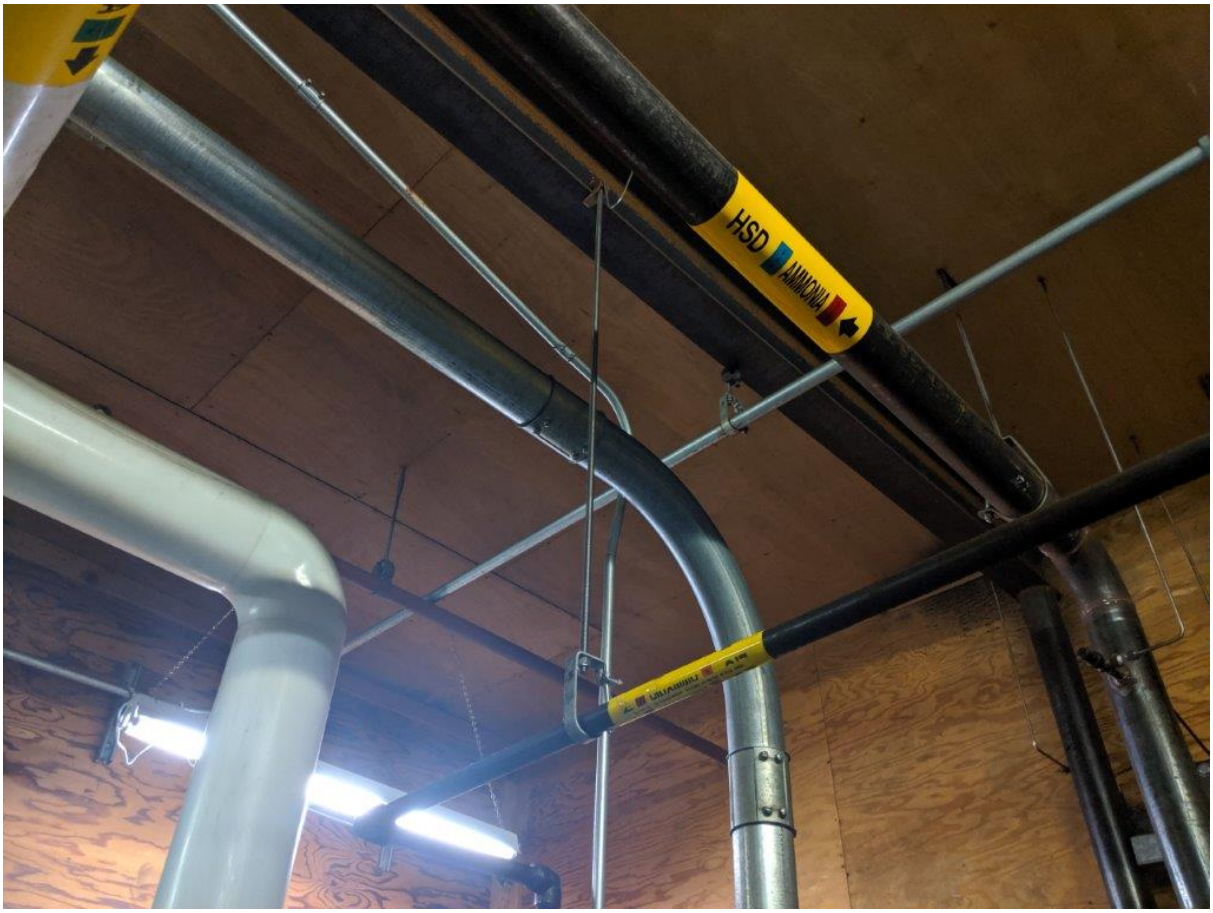
Caption 33. Ice Builder 1 Surge Drum 2

Caption 34. Ice Builder 2 [Action Item 6]

Caption 35. Ice Builder 2 Surge Drum

Caption 36. Ice Builder 1 Surge Drum 2 RV Pipe Fastener [Action Item 7]

Caption 37. Fire Diffusion Box



Caption 38. Compressor 1 LIC Pipe [Action Item 8]

Caption 39. Compressor 2 LIC Pipe [Action Item 8]

Caption 40. Ammonia Diffusion Tanks

Caption 41. Ammonia Diffusion Tank Anchorage (Typical) [Action Item 6]

Caption 42. Fire Diffusion Box Piping [Action Item 9]

Caption 43. Fire Diffusion Box Piping [Action Item 9]

Caption 44. Cold Box Piping

Caption 45. Cold Box Piping

5-Year Hazard Review of the Ammonia Refrigeration System

For

Petaluma Creamery
621 Western Ave.
Petaluma, CA 94952

Prepared by:

RESOURCE COMPLIANCE

1. Overview

This report documents a *Hazard Review* of the covered process at Petaluma Creamery. The *Hazard Review* was conducted in accordance with the requirements for a *Process Hazard Analysis* (PHA). As such, from this point forward in this report, the *Hazard Review* will be referred to as a PHA. The PHA was conducted in two sessions on February 17-18, 2020. The purpose was to define possible hazards associated with operational deviations, equipment failures, human errors, and other applicable factors. This study was performed in accordance with the California Risk and Process Safety Management regulations.

2. Process Information

2.1 Process Description and Operating Condition

Facility Layout

Petaluma Creamery operates a cheese/butter processing facility in Petaluma, CA. The facility has an ammonia refrigeration system that provides refrigeration capacity to the following:

- (1) Cold Box
- (1) Glycol Chiller
- (2) Ice Builders

Refrigeration System Equipment

The refrigeration system is equipped with evaporators and surge drums as required for flooded or direct expansion operation. A partial list of system components includes:

Machinery Room

- (2) Screw compressors
- (1) Suction accumulator
- (1) Liquid transfer vessel and pump
- (1) High pressure receiver
- (1) Emergency control box
- (1) Auto-purger

Machinery Room Roof

- (1) Evaporative condenser

Ice Builder Area

- (2) Ice builders
- (1) Glycol chiller

Cold Box

- (2) Air-cooling evaporators (ceiling-suspended)

Diffusion Tank Area

- (2) Diffusion Tanks
- (1) Fire Diffusion Box

Process Chemistry

In this system, high pressure liquid from the high pressure receiver is piped to the surge drums associated with the glycol chiller and ice builders. Each surge drum is equipped with an expansion valve

which expands the high pressure liquid into a low temperature and pressure liquid as it enters the vessel. Each surge drum feeds the evaporator mounted below the vessel. The evaporator(s) contain(s) a set of continuous coils through which the low pressure liquid flows. Due to the low pressures and temperatures maintained in the evaporator, the liquid refrigerant absorbs a great deal of heat from the water/glycol and evaporates. Once the liquid has evaporated to form low temperature and pressure vapor, it travels back to the surge drums, through a suction return line, and into the suction accumulator. Any remaining liquid falls to the bottom of the vessel and is fed by gravity into the transfer vessel. A pump mounted under the transfer vessel can be used to move liquid from the transfer vessel to the high pressure receiver. From the suction accumulator, the remaining low pressure vapor is piped to the suction inlet on the screw compressors.

The system also includes direct expansion (DX) ceiling suspended evaporator coils. In DX evaporators, high pressure liquid is supplied from the high pressure receiver directly to the evaporators. Each evaporator is equipped with an expansion valve which reduces the pressure and temperature of the liquid as it enters the evaporator. Once the liquid has evaporated to form low temperature and pressure vapor, it exits the evaporator and is returned to the suction accumulator.

The compressors compress the low pressure vapor, and it exits through the discharge outlet as a high pressure and high temperature vapor. The vapor is then sent to an evaporative condenser where it is cooled and liquefied. The condenser uses air and water to cool the warm ammonia as it passes through a series of tubes within the condenser. As the cooling medium of air and water draws the heat from the vapor, the refrigerant condenses into a liquid and flows to the high pressure receiver. The receiver serves as a holding tank for the liquid refrigerant being fed to the low side, and holds the bulk of the refrigerant in the system when it is not operating.

Safety Systems

Petaluma Creamery has three ammonia detectors installed in the following locations:

- Machinery Room
- Cold Box
- Relief Vent Line

The detectors are connected to a detection panel located outside the machinery room near the maintenance library. In the event of a release, the detectors will activate the horns and lights on the detection panel.

The Fire Diffusion Box (FDB) was installed in accordance with the Fire Code at the time of construction. The FDB is installed outside, north of the diffusion tanks and contains four (4) valves.

- Valve #1: High Side Discharge Valve
- Valve #2: Low Side Discharge Valve
- Valve #3: High to Low Pressure Control Valve
- Valve #4: Water supply valve

Opening Valve #1 will evacuate the process through the high pressure side of the system. Opening Valve #2 will evacuate the process through the low pressure side of the system. Both Valves #1 and 2 discharge into a Fire Diffusion Mixing Chamber which provides the ability to dilute the ammonia in water by opening Valve #4. Valves #1 and 2 should never be opened without first opening Valve #4. Opening Valve #3 will equalize the high and low pressure portions of the system.

Each screw compressor has numerous safety devices to protect the compressor and the associated equipment.

The suction accumulator is equipped with a high level float switch that is wired to shut down the compressors in the event of a high level situation. This prevents liquid ammonia from entering the compressors.

Process Classification

The ammonia refrigeration system at Petaluma Creamery consists of vessels, equipment, and valves which are interconnected by piping. As such, the refrigeration system at Petaluma Creamery is treated as a single process.

2.2 Process Safety Information

During this PHA, process safety information was available and considered by the team. The information included the following:

- *Safety Data Sheet*
- *Block Flow Diagram*
- *Process Chemistry*
- *Maximum Intended Inventory*
- *Safe Operating Limits and Consequence of Deviation*
- *Materials of Construction*
- *Piping and Instrumentation Diagrams*
- *Electrical Classification*
- *Relief System Design and Design Basis*
- *Ventilation System Design*
- *Design Codes and Standards Employed*
- *Material and Energy Balances*
- *Safety Systems*

All of this process safety information is organized and available at all times to the operator and all other employees at the Petaluma Creamery facility. By this reference it is included in this PHA study.

It is unknown which codes and standards were used when the ammonia refrigeration system was installed at Petaluma Creamery. The system is believed to have been originally installed in 1989 by Refrigeration Technologies according to the “Manufactured for” field on the High Pressure Receiver U-1A Form.

In 1997 the system was modified by Apcco in the following ways:
- Existing compressors were replaced with FES screw compressors
- Glycol heat exchanger and surge drum were installed
- Condenser 2 was installed (presumably to replace Condenser 1)

In 2003, the system was modified in the following ways:
- Evaporators EV2-EV3 were decommissioned;
- A new evaporator was installed and named ‘Evaporator EV2’;
- An auto-purger was installed;
- The relief valve discharge piping was modified to terminate into an ammonia diffusion tank.

In 2009 Apcco was hired to replace the Ice Builder 2 surge drum with a new vessel.

Petaluma Creamery is in possession of manufacturer data reports for select pressure vessels which indicate that the design and construction of the vessels complies with the ASME Boiler and Pressure Vessel Code Section VIII, Division 1 at the time of construction. For example, the Liquid Transfer Vessel was manufactured in 1989 in accordance with the 1986 ASME Boiler and Pressure Vessel Code Section

VIII, Division 1.

3. Process Hazard Analysis

3.1 Process Hazard Analysis Team

The *PHA* team was composed of the following team members:

First Name	Last Name	Title	Company	Expertise
Nate	Torres	Operations Manager	Resource Compliance, Inc.	Process Safety Management PHA Team Leadership
Fernando	Ortiz	Maintenance Manager	Petaluma Creamery	Process Operations Ammonia Refrigeration
Larry	Peter	Owner	Petaluma Creamery	Process Operations

The PHA leader was Nate Torres, Process Safety Consultant at Resource Compliance. Nate has a degree in Business Finance from the California State University Fresno and has participated in numerous ammonia refrigeration PHAs. Nate successfully completed the "*Process Hazard Analysis - Emphasizing Ammonia Refrigeration Systems"* course offered through the Industrial Refrigeration Consortium at the University of Wisconsin-Madison, and has successfully passed a RETA exam to become credentialed as a 'Certified Assistant Refrigeration Operator' (CARO).

3.2 Process Hazard Analysis Session

The methodology used was What-If/Checklist, one of the methodologies listed in the California and Federal Risk and Process Safety Management regulations. The PHA team utilized the checklists contained within PSMWriter, software developed and distributed by Resource Compliance, Inc. This material was supplemented and modified by the team leader based on insights gained from previous PHAs. The team leader instructed the team members on the methodology and risk ranking criteria prior to commencing the PHA study.

The What-If/Checklist PHA was implemented according to the following procedure:

1. A section of the system was selected for study (a "node")
2. A checklist "What If…" question was asked. The checklist covered deviation and accident areas such as impact, changes in process variables, instrumentation, and others.
3. The team identified scenarios and specific associated hazards, which may result from the situation posed in the "What If…" question.
4. The team ranked the possible likelihood and consequences of the identified scenarios.
5. The team identified existing safeguards.
6. The team made appropriate recommendations for action tasks (e.g. to implement additional safeguards or collect more information about the scenario).
7. Steps 3 – 6 were repeated until no more scenarios/hazards are identified for that "What If…" question.
8. The team returned to Step 2 and selects a new "What If…" question. Steps 3 – 6 were repeated for the new question.
9. The team was encouraged to pose additional "What If…" questions drawing upon their personal experiences or knowledge of the system being studied. Steps 3 – 7 were repeated for each new question posed.
10. After all of the "What If…" questions had been asked, and all of the scenarios/hazards had been identified for each question, the team returned to Step 1 and selected a new section of the system (a new "node"). Steps 2 – 9 were repeated for each node until the covered process was

completely covered and characterized.

3.3 Factors Considered

3.3.1 Past Accident History

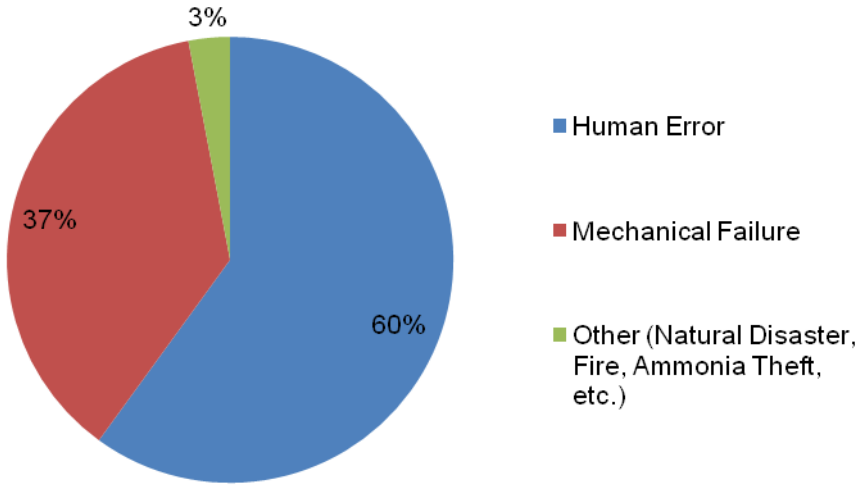
In addition, the team used past experience and knowledge of accidents at other facilities as examples of potential accidents that could occur at this facility. These accidents were discussed to reveal possible causes that might apply to future accidents at this facility, and to recommend appropriate mitigation procedures. A summary of chemical accidents that were reviewed during the PHA include:

Event Description	Event Date	Items Discussed
Technicians Injured In Auto-Purger Accident	October 24, 2014	● Importance of annual maintenance ● Importance of employee training
Ammonia Tanker Crash (Corcoran, CA)	November 28, 2016	● Human factors influence on hazmats ● Importance of employee training
Roof Collapse and Evaporator Leak (Sanger, CA)	December 15, 2016	● Importance of a sound building structure ● Importance of mechanical integrity
Inspector Steps Through Roof at Ventura Facility (Ventura, CA)	September 12, 2018	● Importance of a sound building structure ● Importance of a daily walk-through ● Importance of annual maintenance
Ammonia Theft at an Ammonia Cold Storage	February 12, 2019	● Importance of security at a chemical facility ● Consideration of location of chemical equipment and the potential for vandalism/theft

In addition to reviewing incidents that have occurred at other facilities, the PHA team also reviewed an article titled, *Low Charge Systems May Be the Answer*, which was published in the May 2010 issue of the *Condenser* (a publication of the International Institute of Ammonia Refrigeration). This article summarized the results of a 12-question survey about ammonia releases from 700 respondents. The survey found the following about the location of leaks in refrigeration systems:

Location	Responses	Percentage
Flanges/Joints	110	23
Control Valves	96	20
Pumps	58	12
Pressure Relief Valves	43	9
Compressors	41	9
Oil Pots	40	8
Piping	35	7
Charging Transfer	21	5
Evaporators	19	4
Sight Glass	7	1
Storage Tank/Receiver	1	-
Total	471	100

In addition, the survey found the following about the cause of ammonia leaks in refrigeration systems:



The team used the information provided in this article to assist in assigning risk rankings and determining the probability of scenarios taking place at their facility.

3.3.2 Human Factors

Issues regarding human factors were addressed as an integral part of the PHA. A majority of the "What If…" questions posed for specific system components were based on the assumption that an incorrect action would be performed by a person.

In addition, as a supplement to these considerations, a section was devoted to human factors. The team was asked to consider factors including but not limited to under-staffing, human fatigue, system access, and substance abuse.

3.3.3 Seismic Factors

The CalARP regulation (§2755.2(d)) requires that "*The hazard review shall include the consideration of applicable external events, including seismic events.*"

It is the practice of Petaluma Creamery to design, build, and maintain the covered process in compliance with building standards in the industry. Questions posed in the "external events" and "global system factors" components of the PHA verified that this policy has been adhered to. By so doing, it is the position of Petaluma Creamery that reasonable and prudent precautions have been taken to prevent releases due to seismic events that may be expected to occur in the area.

In the event that a severe seismic event was to occur, the consequences would be no worse than those already identified in the worst-case scenario documented in the Hazard Assessment portion of the Risk Management Program.

4. Risk Matrix

Severity	Likelihood			
	1 - Improbable	2 - Occasional	3 - Periodic	4 - Frequent
1 - Slight	A	A	A	A
2 - Moderate	A	A	C	N
3 - Severe	A	C	N	U
4 - Catastrophic	C	N	U	U

4.1 Severity Descriptions

1 - Slight: Not detectable by employees/Not reportable/No downtime/<$5K Costs

2 - Moderate: Odor to employee(s)/<Reportable qty/<1 Day downtime/$5-25K Costs

3 - Severe: Reportable injury(ies)/>Reportable qty/1-5 Days downtime/$25-100K Costs

4 - Catastrophic: Serious injury(ies) or fatality/Offsite injury(ies)/>5 Days downtime/>$100K Costs

4.2 Likelihood Descriptions

1 - Improbable: Not expected to occur in the lifetime of the facility/Less than once in 20 years

2 - Occasional: Could occur once in the lifetime of the facility/Once in 20 years

3 - Periodic: Could occur several times in the lifetime of the facility/Once every five years

4 - Frequent: Occurs frequently/One or more times a year

4.3 Risk Ranking Descriptions

A: Acceptable - No risk control measures are needed

C: Acceptable with Control - Risk control measures are in place

N: Not Desirable - Risk control measures to be introduced within a specified time period

U: Unacceptable - Risk control measures to be completed at the earliest possible opportunity

5. Process Hazard Analysis Worksheets and Reports

Detailed reports concerning the *Process Hazard Analysis* have been attached to the end of this document. Reports include:

- Facility Information
- Process Information
- Safeguards
- Subsystems
- What-If Checklist
- Sessions
- Recommendations Report - Each recommendation is assigned a priority ranking based on the following definitions:

  Priority 1 (Critical) - Serious violation and/or safety issue exists. Address deficiency immediately.

  Priority 2 (Urgent) - Violation and/or safety issue exists. Address deficiency in the near future.

  Priority 3 (Improvement) - Violation and/or safety issue exists, but is not urgent. Address deficiency in accordance with good business practice.

  Priority 4 (Optional) - No violation exists, addressing the deficiency is optional.

PHA Report

Facility Information

Facility Name:	Petaluma Creamery	Phone:	
Physical Address:	621 Western Avenue	Fax:	
		Email/Website:	
City:	Petaluma		
State:	CA		
Zip:	94952		
Mailing Address	621 Western Avenue		
City	Petaluma		
State:	CA		
Zip:	94952		

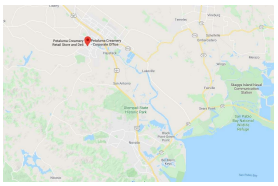
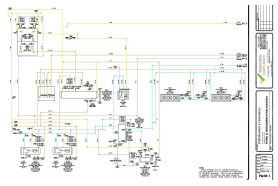
Process Information

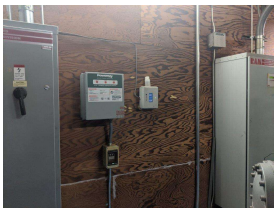
Process ID #	P1	Facility Name:	Petaluma Creamery
Process Name:	Ammonia Refrigeration		
Process Location:	Petaluma Creamery		
US EPA Program Level:	N/A	State EPA Program Level:	2
OSHA PSM Process?	No		
Comments:			

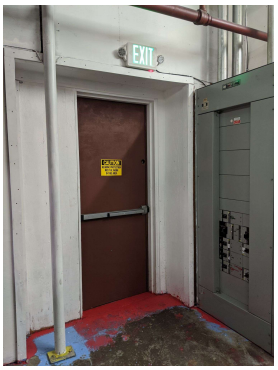
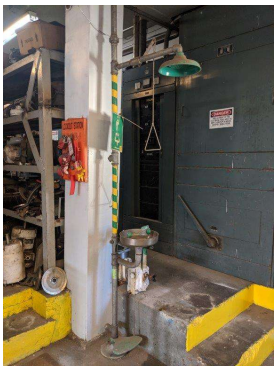
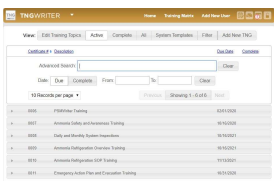
Chemical Information

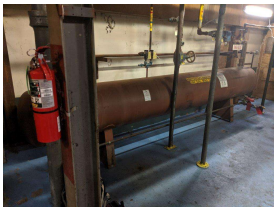
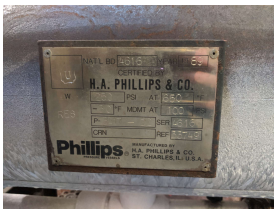
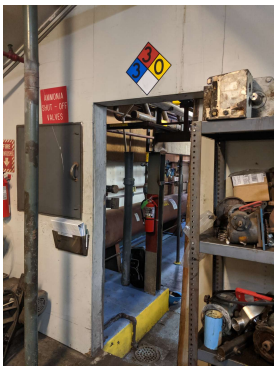
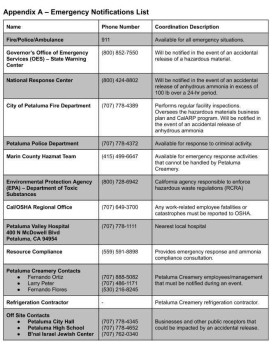
Chemical Name	CAS #	Quantity
Ammonia (anhydrous)	7664–41–7	4000.00

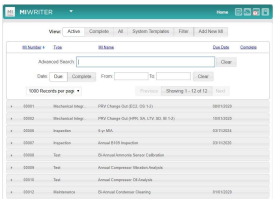
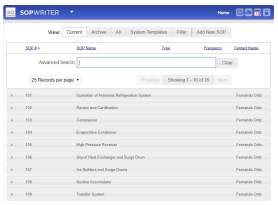
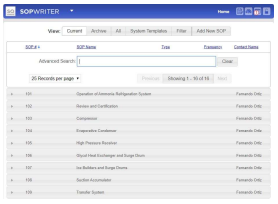
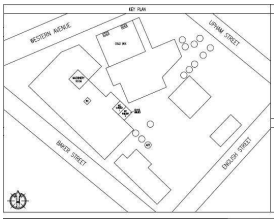
Safeguards

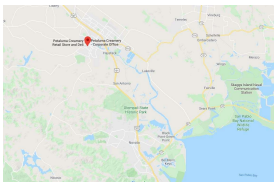
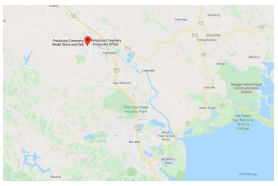
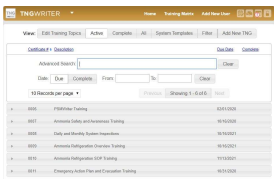
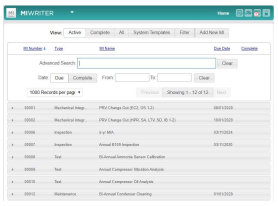
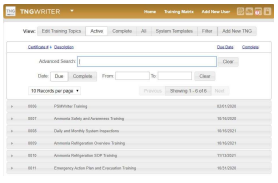
Safeguard	Image
1: A drought would affect the products being refrigerated before it would affect the refrigeration system.	
2: All employees are encouraged to share their opinions on how to make the business better or safer.	
3: All employees are made aware of their responsibilities.	PETALUMA CREAMERY EST. 1913
4: All facility ASME pressure vessels, heat exchangers, and positive displacement compressors are equipped with relief valves.	
5: All necessary process safety information has been gathered and is readily available.	
6: All refrigeration contractors are required to be qualified through the facility CalARP program.	PETALUMA CREAMERY EST. 1913
7: All relief valves have a set pressure equal to or less than the MAWP of the equipment that the relief valve protects.	
8: All relief valves have capacity which meets or exceeds the requirement of ANSI/IIAR 2-2014 Addendum A §15.3.8.	
9: All relief valves terminate into the ammonia diffusion tank. The termination pipe is installed in such	

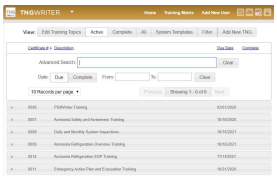
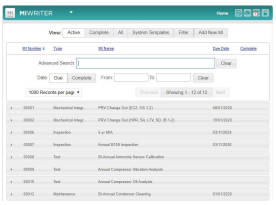
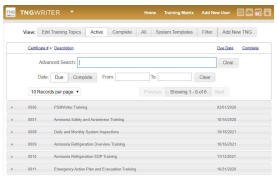
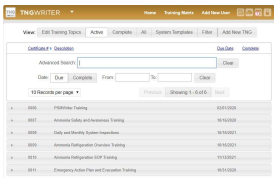
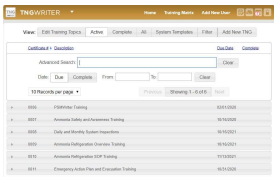
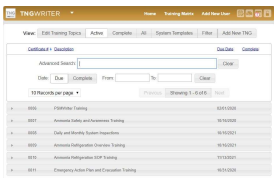
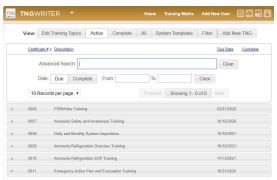
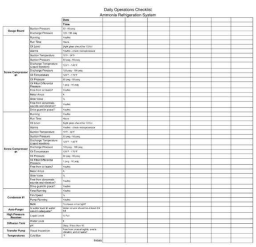
a way as to prevent employees from being impacted by a release or water from accumulating in the relief piping.	
10: All relief valves were installed in August and October of 2015.	
11: All the compressors are equipped with a discharge check valve to prevent vapor from entering the separator when "OFF".	
12: Alliance Industrial Refrigeration is on call 24/7 to assist with maintenance and/or repairs that onsite operators are unequipped to handle.	
13: Ammonia detectors are installed in the following locations; Machinery Room, Cold Box, and Relief Vent Line, which is where leaks are likely to develop.	
14: Ammonia is added to the system infrequently and only after determining the specific amount that can be safely held within the system.	
15: Ammonia is used in process and equipment rooms that are classified and not normally occupied. Large populations may work adjacent to the rooms, but have been trained in the facility emergency procedures.	
16: Ammonia supplier trucks are equipped with excess flow valves. These would serve to stop a leak if a hose coupling accident were to occur.	
17: Both doors to/from the machinery room open outwards and are equipped with panic hardware.	

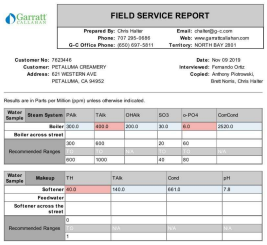
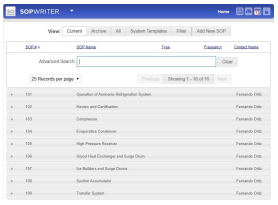
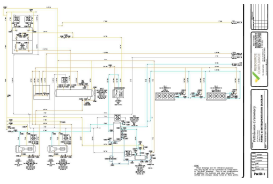
	
18: Each compressor is equipped with an oil heater to keep the ammonia and oil at a suitable temperature when the compressors are in 'Standby'.	
19: Each valve in the emergency control box is clearly labeled.	
20: Emergency eyewash and shower stations are in various locations throughout the facility including inside the machinery room and directly outside the machinery room in the maintenance shop.	
21: Employees have been trained for emergency evacuation. This training includes consideration of wind direction, location of ammonia systems, and all other employee responsibilities in an emergency.	
22: Glycol samples are taken and analyzed every six months to ensure that the concentration is correct.	PETALUMA CREAMERY EST. 1913
23: Incidental ammonia leaks are addressed as soon as they are discovered.	PETALUMA CREAMERY EST. 1913
24: Most ammonia equipment is located indoors.	

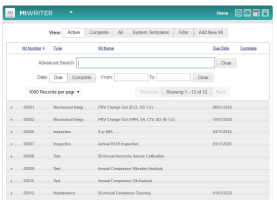
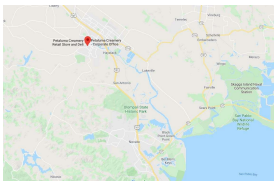
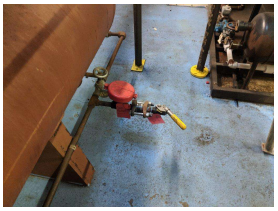
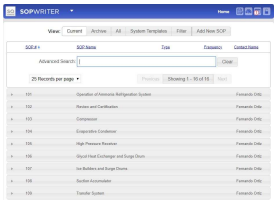
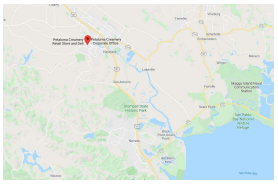
	
25: Most critical pipe, valves, equipment, and controls are clearly labeled.	
26: Most of the facility's ammonia refrigeration equipment is on the roof or in secured buildings. Other equipment is out sight from public view.	PETALUMA CREAMERY EST. 1913
27: Most of the valves on the high pressure receiver is adequately protected from inadvertent impact.	
28: Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.	
29: Most rooms (non-restrooms) have multiple doors available to escape during a leak.	
30: Off-Site notification list with contacts and phone numbers is included in the emergency response/action program.	
31: Periodic maintenance and cleaning is performed on the two evaporators.	

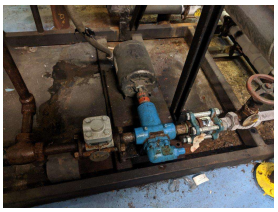
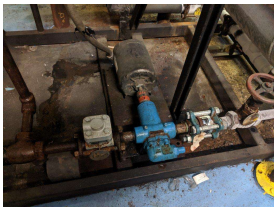
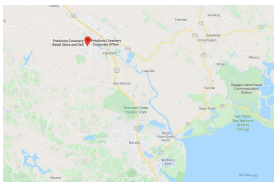
	
32: Petaluma Creamery does not disassemble and clean the plate and frame heat exchanger plates on a routine basis.	
33: Petaluma Creamery encourages safe working practices.	
34: Petaluma Creamery has an operating procedure for safely draining oil from an oil drain valve.	
35: Petaluma Creamery has an operating procedure for safely operating a compressor.	
36: Petaluma Creamery has contracted with a pest control company, Ecolab, to remove pests periodically.	
37: Petaluma Creamery has developed and implemented a lockout/tagout program to protect workers from this type of hazard.	
38: Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations.	
39: Petaluma Creamery has two (2) windsocks installed at the corners of the facility to aid in the event of an evacuation.	

	
40: Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.	Apcco Applied Process Cooling Corporation
41: Petaluma Creamery hired Resource Compliance to perform a CalARP Seismic Assessment of the ammonia refrigeration equipment. The assessment was performed by Peter Thomas, P.E. and a report of findings was prepared on 9/30/19.	RESOURCE COMPLIANCE
42: Petaluma Creamery is not in a location where heavy flooding is likely.	
43: Petaluma Creamery is not located near a railroad.	
44: Petaluma Creamery only uses refrigerant-grade anhydrous ammonia which reduces non-condensables in the system.	PETALUMA CREAMERY EST. 1913
45: Petaluma Creamery operators have been trained as to the hazards of anhydrous ammonia and have been instructed not to use the emergency control box.	
46: Petaluma Creamery performs mechanical integrity inspections on the ammonia refrigeration system to identify locations of the system where plugs/caps are missing and makes the repairs when appropriate.	
47: Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).	
48: Petaluma Creamery personnel have been trained to not use cheater bars on ammonia valves.	

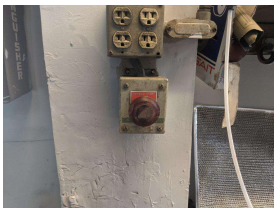
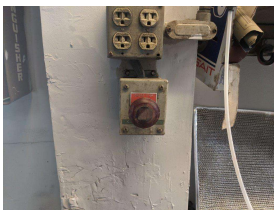
	
49: Petaluma Creamery personnel perform fan maintenance annually.	
50: Petaluma Creamery refrigeration personnel are trained in the use of the refrigeration controls.	
51: Petaluma Creamery refrigeration personnel are trained on the proper use of the emergency refrigeration switch.	
52: Petaluma Creamery refrigeration personnel have been trained as to the hazards of anhydrous ammonia including the dangers of trapping liquid ammonia in pipes/equipment.	
53: Petaluma Creamery refrigeration personnel have been trained in the facility ammonia line break procedure.	
54: Petaluma Creamery refrigeration personnel have been trained to make sure that no single vessel is filled beyond 85%.	
55: Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.	
56: Petaluma Creamery refrigeration system is equipped with an auto-purger which negates the need to purge non-condensables manually.	

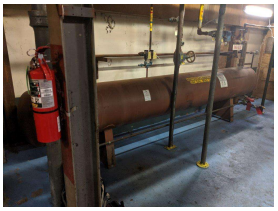
	
57: Petaluma Creamery replaces any relief valve immediately after they become aware that the valve has lifted.	
58: Petaluma Creamery uses a qualified water treatment company, Garrett-Callahan, to oversee this type of work.	
59: Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297)	
60: Petaluma Creamery utilizes cell phones to coordinate during an emergency situation.	
61: Procedures for emergency operations have been developed and implemented as required by CalARP.	
62: Redundancy in system allows individual shutdown of components.	
63: Relief valves are installed to protect the plate and frame heat exchanger from over-pressurization.	
64: Routine maintenance is performed on the condensers.	

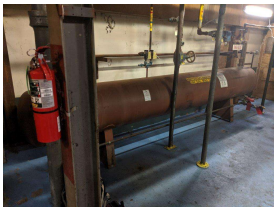
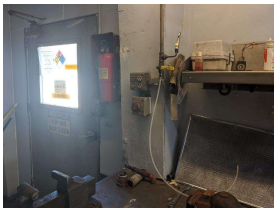
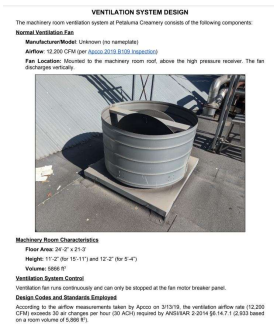
	
65: Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.	
66: Severe rainstorms are not common in this region.	
67: Spring return valves are used when draining oil, which require continuous attention.	
68: Staff depth is sufficient to spread out the workload and responsibilities.	PETALUMA CREAMERY EST. 1913
69: Standard operating procedures (SOPs) for the refrigeration system have been developed and are reviewed annually.	
70: Temperatures rarely reach freezing temperatures for prolonged periods of time.	
71: The ammonia diffusion tank is equipped with a vent line sensor to alert refrigeration personnel in the event of a discharge into the tank.	
72: The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting.	
73: The ammonia pump is equipped with a pressure gauge, which provides the provision to purge	

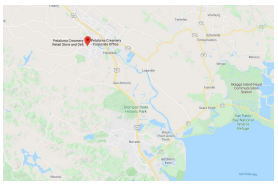
ammonia between the pump isolation valve and check valves.	
74: The ammonia pump is located inside the machinery room which is restricted to authorized personnel only.	
75: The ammonia refrigeration process is not located in an area where high winds are a threat or concern.	
76: the auto purger has been in service several years and has shown no indication of insufficient cooling.	
77: The auto-purger is located inside the machinery room which is restricted to authorized personnel only.	
78: The ceiling suspended evaporators are installed above the racking system and protected from being impacted by stored product.	
79: The compressor safety devices (high pressure cutout, low pressure cutout, and oil pressure cutout) are tested for proper operation periodically. The last test was performed 6/20/2018.	
80: The compressor set points are restricted by range limits to prevent unsafe settings.	

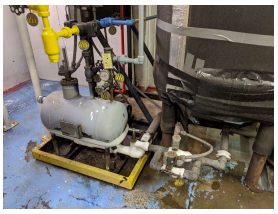
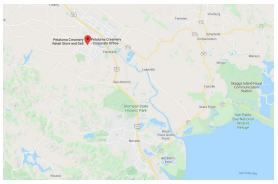
	
81: The compressors are equipped with "local" cutouts which will shut them off.	
82: The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts.	
83: The compressors are equipped with oil level cutouts that will shut them down if the oil level is outside of the acceptable range.	
84: The compressors are equipped with oil temperature cutouts that will prevent start up and also shut it down if the oil temperature is outside of the acceptable range.	
85: The compressors are equipped with oil temperature cutouts that will shut them down if the oil temperature is outside of the acceptable range.	
86: The compressors are equipped with pressure relief valves which protect the equipment from over-pressurization.	
87: The compressors are located inside the machinery room which is restricted to authorized personnel only.	
88: The condenser is equipped with multiple condenser fans, which allows the condenser to continue to operate when only one condenser fan fails.	

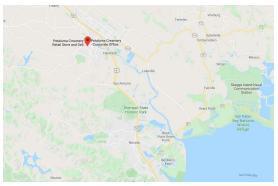
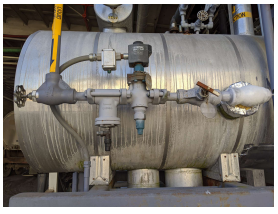
	
89: The design and construction of equipment can withstand a severe hailstorm.	
90: The discharge from the machinery room ventilation fan(s) is on the roof and at least 20 ft from a property line or building opening.	
91: The e-stop is tested for proper operation periodically. The last test was performed on 7/3/2018.	
92: The electrical transformers are protected by three walls and a concrete curb with a chain link gate.	
93: The emergency control box is clearly labeled.	
94: The emergency control box is protected by barrier posts.	
95: The emergency refrigeration switch (e-stop) is labeled.	
96: The emergency ventilation switch is located outside the machinery room in the maintenance shop.	

	
97: The emergency ventilation switch is tested for proper operation periodically. The last test was performed on 7/3/2018.	
98: The evaporative condenser is located on the machinery room roof which is inaccessible to vehicular traffic.	
99: The glycol concentration is 30%, which corresponds to a freeze point of 7°F which is well below the normal ammonia temperature.	
100: The high level float switch is tested for proper operation periodically. The last test was performed on 7/17/2018.	
101: The high pressure receiver combined, with other system vessels, have capacity to hold the entire ammonia inventory.	
102: The high pressure receiver is equipped with a single "King Valve" that is clearly labeled.	
103: The high pressure receiver is located inside the machinery room which is restricted to authorized personnel only.	

	
104: The lighting in the machinery room is adequate and equipped with manual control switches.	
105: The liquid transfer vessel is located inside the machinery room which is restricted to authorized personnel only.	
106: The machinery room is equipped with a ventilation system to help reduce the ammonia concentration if a leak were to occur inside the machinery room.	
107: The machinery room is equipped with an emergency refrigeration switch (e-stop) outside the principal machinery room door, which is located in the maintenance room.	
108: The machinery room is not used for the storage of flammable materials.	
109: The machinery room ventilation fan is capable of moving 12,200 CFM of air which exceeds the 30ACH requirement of ANSI/IIAR 2-2014 Addendum A §6.14.7.1.	
110: The Main Suction Accumulator has been in service since 1989 and has shown no indication of being undersized.	

	
111: The main suction accumulator is equipped with a high level float switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator.	
112: The main suction accumulator is located inside the machinery room which is restricted to authorized personnel only.	
113: The normal ammonia temperature in the heat exchanger is not capable of freezing the glycol.	
114: The panel to change compressor set-points is controlled locally at the compressor panel in the machinery room which is restricted to authorized personnel only.	
115: The power is not likely to be out long enough for suction pressures to rise significantly.	
116: The refrigeration controls are not accessible over the internet.	

117: The refrigeration system is controlled by compressor panels, thermostats, and relay switches. There is no PLC/computer control.	
118: The refrigeration system is equipped with a liquid transfer vessel which would transfer the excess liquid from the main suction accumulator to the high pressure receiver.	
119: The refrigeration system is equipped with a main suction accumulator which would collect the excess liquid before allowing it to enter the compressors.	
120: The sight glass on the high pressure receiver is a bull's eye column type which can withstand most minor physical impact.	
121: The surge drums are located above the ice builders which are inaccessible to vehicle traffic.	
122: The system has been designed to operate during times of year that experience high ambient temperatures.	
123: The system is operational year-round.	

124: The ventilation fan runs continuously and can be stopped at the fan motor breaker panel or the emergency ventilation switch outside the machinery room.	
125: The water level in the diffusion tank and the pH of the water are checked monthly.	
126: There are no hazardous chemical facilities within two miles.	
127: There are no relief valves installed which discharge back into the refrigeration system.	
128: There are no stop valves installed before/after any of the relief valves.	
129: There is no fumigation process at the facility that exposes the evaporators to harsh chemicals such as sulfur dioxide.	
130: Valve groups are equipped with a provision for ammonia removal (service valve at the strainer) which provides a safe location to remove ammonia when isolating a valve group.	
131: Vendors are closely monitored and check in with an operator when performing work on site.	
132: Water pipes can be quickly repaired by facility personnel.	
133: Water samples are taken and analyzed on a regular basis to ensure that the concentrations of corrosive elements are within safe levels.	

	
134: When operation requires extra hours, multiple shifts are introduced.	

Subsystems

Subsystem	Type	Design Conditions/Parameters
1: High Pressure Receiver	Vessel	The purpose of the high pressure receiver is to provide a safe location to add and store high pressure liquid ammonia. The high pressure receiver receives high pressure liquid from the condenser and supplies high pressure liquid to the evaporators, ice builders, and glycol heat exchanger. The high pressure receiver is also used to provide storage for ammonia not being used in the process at any given moment. Under normal conditions, the high pressure receiver contains high pressure liquid and vapor ammonia. **Equipment** High Pressure Receiver HPR1
2: Surge Drums	Vessel	The purpose of the surge drums is to provide a supply of liquid ammonia to the heat exchangers they serve. The surge drums receive liquid from the high pressure receiver and supply, by gravity, low pressure liquid to the heat exchangers. Liquid and vapor returned from the heat exchangers is separated inside the surge drums to allow only the vapor to be returned to the main suction accumulator. Under normal conditions, the surge drums contain low pressure liquid and vapor ammonia. **Equipment** Surge Drum SD1 Ice Builder IB1 Surge Drum 1 Ice Builder IB1 Surge Drum 2 Ice Builder IB2 Surge Drum
3: Transfer Pump	Centrifugal Pump	The transfer pump receives liquid ammonia from the Liquid Transfer Vessel, and moves the liquid to the High Pressure Receiver. Under normal conditions, the ammonia pump contains high pressure liquid ammonia. **Equipment** Transfer Pump
4: Ceiling Suspended Evaporators	Heat Exchanger (Evaporator)	The purpose of the ceiling suspended evaporators is to remove heat from the air in order to maintain a predetermined space temperature. The ceiling suspended evaporators receive liquid from the high pressure receiver. Low pressure liquid and vapor exits the ceiling suspended evaporators and is returned to the main suction accumulator. Under normal conditions, the ceiling suspended evaporators contains low pressure liquid and vapor ammonia. **Equipment** Cold Box Evaporator EV1 Cold Box Evaporator EV2
5: Plate & Frame Heat Exchanger	Heat Exchanger (Evaporator)	The purpose of the plate and frame heat exchanger is to remove heat from the glycol solution being pumped through it. The plate and frame heat exchanger receives liquid from a surge drum. Low pressure liquid and vapor exits the plate and frame heat exchanger and is returned to the flooded accumulator. Under normal conditions, the plate and frame heat exchanger contains low pressure liquid and vapor ammonia. **Equipment**

		Glycol Heat Exchanger HX1
6: Ice Builders	Heat Exchanger (Evaporator)	The purpose of the ice builders is to remove heat from the water being moved through it as necessary to make ice. The Ice Builders receive liquid from a flooded accumulator. Low pressure liquid and vapor exits the Ice Builders and is returned to the surge drums. Under normal conditions, the Ice Builders contain low pressure liquid and vapor ammonia. **Equipment** Ice Builder IB1 Ice Builder IB2
7: Main Suction Accumulator	Vessel	The purpose of the main suction accumulator is to prevent liquid from entering the compressors. The main suction accumulator receives vapor from the surge drums and evaporators, and separates any residual liquid from the vapor to allow only the vapor to be piped to the suction of each compressor. Liquid in the main suction accumulator drains by gravity into the liquid transfer vessel. Under normal conditions, the main suction accumulator contains low pressure vapor ammonia. **Equipment** Suction Accumulator SA1
8: Liquid Transfer Vessel	Vessel	The purpose of the liquid transfer vessel is to move liquid from the low side of the refrigeration system back to the high pressure receiver. The liquid transfer vessel receives liquid from the main suction accumulator. Once the liquid level in the liquid transfer vessel reaches the float switch, the 3-way solenoid valve is energized for a period of time causing the liquid transfer vessel to become subject to high pressure and energizing the transfer pump so that the liquid can be moved from the transfer vessel to the high pressure receiver. Under normal conditions the liquid transfer vessel can contain either high or low pressure liquid and vapor. **Equipment** Liquid Transfer Vessel LT1
9: Screw Compressors	Positive Displacement Compressor	The purpose of the screw compressors is to raise the temperature and pressure of the low pressure gas in order to reject the heat absorbed in the evaporators to the atmosphere. The screw compressors receive low pressure vapor from the main suction accumulator and discharges high pressure vapor to the evaporative condenser. Under normal conditions, the screw compressors contain both high and low pressure vapor ammonia. **Equipment** Compressor RC1 Compressor RC2
10: Evaporative Condenser	Heat Exchanger (Condenser)	The purpose of the evaporative condenser is to reject the heat absorbed in the evaporators to the atmosphere. The evaporative condenser receives high pressure vapor from the compressors and supplies high pressure liquid to the high pressure receiver. Under normal conditions, the evaporative condenser contains high pressure liquid and vapor ammonia. **Equipment**

		Condenser EC2
11: Piping	Pipe	The purpose of piping is to connect refrigeration equipment, vessels and valves to form a closed loop cycle. Pipes containing low pressure ammonia are typically insulated, while pipes containing high pressure ammonia are painted. Under normal conditions, the piping can contain both high and low pressure liquid and vapor ammonia.
12: Valves	Valve	The purpose of a valve is to provide the ability to isolate refrigeration system equipment, drain ammonia, purge ammonia, add additional ammonia to the system, throttle flow to select system components, and maintain space temperatures. Under normal conditions, a valve can contain both high and low pressure liquid and vapor ammonia.
13: Relief Valves	Valve	The purpose of a relief valve is to provide over-pressurization protection to system components. Relief valves are installed on the vapor space of each pressure vessel and positive displacement compressor. In the event that a relief valve is opened, the high pressure vapor is discharged to the ammonia diffusion tank or atmosphere. Under normal conditions, the relief valves are subject to either high or low pressure ammonia vapor. **Equipment** OS RC1 Relief Valve 1 OS RC1 Relief Valve 2 OS RC2 Relief Valve 1 OS RC2 Relief Valve 2 Condenser EC2 Relief Valve 1 Condenser EC2 Relief Valve 2 Condenser EC2 Relief Valve 3 Condenser EC2 Relief Valve 4 HPR1 Relief Valve 1 HPR1 Relief Valve 2 Ice Builder IB1 Surge Drum 1 Relief Valve 1 Ice Builder IB1 Surge Drum 1 Relief Valve 2 Ice Builder IB1 Surge Drum 2 Relief Valve 1 Ice Builder IB1 Surge Drum 2 Relief Valve 2 Ice Builder IB2 Surge Drum Relief Valve 1 Ice Builder IB2 Surge Drum Relief Valve 2 LT1 Relief Valve SA1 Relief Valve 1 SA1 Relief Valve 2 Surge Drum SD1 Relief Valve 1 Surge Drum SD1 Relief Valve 2
14: Ammonia Diffusion Tank	Tank	The purpose of the ammonia diffusion tank is to provide passive containment of ammonia vapor in the event that a relief valve is opened. The ammonia diffusion tank contains water. The relief valve discharge piping is terminated at the bottom of the ammonia diffusion tank. Under normal conditions, the ammonia diffusion tank contains water. **Equipment** Ammonia Diffusion Tank
15: Auto-Purger	Purger	The purpose of the auto-purger is to remove non-condensable gases from the system without requiring

		the system to be manually opened. The auto-purger consists of the following components: automatic water bubbler, foul gas line, liquid line, suction line, water line, drain line, and remote purge point solenoid valves. Under normal conditions, the auto-purger can contain small quantities of ammonia and water. **Equipment** Auto-Purger
16: Emergency Ventilation	Emergency Equipment	The purpose of the emergency ventilation is to exhaust ammonia from the machinery room in the event of an ammonia leak. Ventilation fan runs continuously and can only be stopped at the fan motor breaker panel or the emergency ventilation switch.
17: Emergency Stop Switch	Emergency Equipment	The purpose of the emergency stop switch is to provide a readily available location to shut off the refrigeration system. The emergency stop switch is used in emergency situations to power down the refrigeration equipment in a machinery room during an emergency.
18: Emergency Control Box	Emergency Equipment	The purpose of the emergency control box is to manually purge ammonia from the system or equalize the pressure between the high and low pressure sides of the system during an emergency. The emergency control box consists of the following components: high-side discharge valve, low-side discharge valve, and equalizer valve. Under normal conditions, the emergency control box valves are closed and are subject to both high and low pressure ammonia vapor. **Equipment** Fire Dump Box
19: Ammonia Detection	Emergency Equipment	The purpose of ammonia detection is to provide notification of the presence of ammonia. The detectors are connected to a detection panel located outside the machinery room near the maintenance library. In the event of a release, the detectors will activate the horns and lights on the detection panel. **Equipment** Detector - Cold Box Detector - Machinery Room Detector - Relief Vent
20: Computer Controls	Instrumentation & Control	The purpose of the computer controls is to provide readily accessible control and alarm capability for the refrigeration system.
21: External Events	Emergency Situations	This section considers external events, including seismic events at the facility.
22: Emergency Situation	Procedures	This section documents facility procedures and policies regarding emergency situations.
23: Facility Siting	Hazardous Situations	This section assesses the potential consequences of known facility hazards.
24: Global System Factors	Design & Maintenance	This section considers aspects of the system that are global in nature.
25: Human Factors	Human Error	This section considers sources of human error which may impact operation of the system.

PHA Checklist

1: High Pressure Receiver

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	The purge valve on the bottom of the bull's-eye column is broken off when someone steps on it.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. Most of the valves on the high pressure receiver is adequately protected from inadvertent impact. 2. The high pressure receiver is located inside the machinery room which is restricted to authorized personnel only.
2: What if the sight glass or bull's-eye column is broken by impact? (ANSI/IIAR 2-2014 Addendum A §5.17.1, §16.2.2)	A forklift driver accidentally bumps the bull's-eye column or sight glass.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. The high pressure receiver is located inside the machinery room which is restricted to authorized personnel only. 2. The sight glass on the high pressure receiver is a bull's eye column type which can withstand most minor physical impact.
3: What if critical valves on the high pressure receiver are not labeled or easily identified? (ANSI/IIAR 2-2014 Addendum A §5.14.4)	During an emergency, there is confusion as to which "King Valve" or other isolation valve to operate because the high pressure receiver valves are not labeled.	1. Delayed emergency response 2. Incorrect emergency response 3. Injury	3	1	A	1. The high pressure receiver is equipped with a single "King Valve" that is clearly labeled.
4: What if a crack develops in the shell of the high pressure receiver? (ANSI/IIAR 2-2014 Addendum A Appendix H)	The phenomenon called stress corrosion cracking (SCC) causes cracks to develop in the vessel.	1. Death 2. High pressure liquid ammonia release 3. High pressure vapor ammonia release 4. Injury 5. Reactive maintenance	4	2	N	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. Petaluma Creamery only uses refrigerant-grade anhydrous ammonia which reduces non-condensables in the system.
5: What if there is an accident when fixing a leak on the sight glass? (ANSI/IIAR 7-2019 §4.3)	While repairing or performing maintenance, an operator incorrectly	1. Death 2. High pressure liquid ammonia release	4	1	C	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their

Recommendation(s):

The refrigeration system's auto-purger is not functioning. It is recommended that the auto-purger be fixed or replaced so non-condensibles can be automatically purged from the ammonia refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

	isolates the level column trapping liquid ammonia between isolation valves.	3. Injury 4. Reactive maintenance				refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 2. Petaluma Creamery refrigeration personnel have been trained in the facility ammonia line break procedure.
6: What if the vessel is emptied? (ANSI/IIAR 7-2019 §10.3(1))	During the off-season, a slow leak reduces the ammonia inventory leaving insufficient ammonia to operate.	1. Insufficient ammonia inventory	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	During low load conditions, liquid ammonia can "hide" in the evaporators, emptying the high pressure receiver. This condition could lead to insufficient ammonia necessary for other parts of the system.	1. Equipment damage 2. Reactive maintenance	3	2	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The compressors are equipped with oil temperature cutouts that will shut them down if the oil temperature is outside of the acceptable range.
7: What if the vessel overflows? (ANSI/IIAR 7-2019 §10.3(1))	An inaccurate assessment of the ammonia inventory leads to a vendor overfilling the system. When the system is pumped down the high pressure receiver fills to the top.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 2. Ammonia is added to the system infrequently and only after determining the specific amount that can be safely held within the system. 3. Petaluma Creamery refrigeration personnel have been trained to make sure that no single vessel is filled beyond 85%.
	The high pressure receiver is undersized for the system and cannot hold the entire ammonia inventory. When the system is pumped down, the high pressure receiver fills to the top.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. Petaluma Creamery refrigeration personnel have been trained to make sure that no single vessel is filled beyond 85%. 2. The high pressure receiver combined, with other system vessels, have capacity to hold the entire ammonia inventory.
	Select evaporators are shutdown leading to less ammonia being removed	1. Death 2. High pressure liquid ammonia release	4	1	C	1. The high pressure receiver combined, with other system vessels, have

	from the high pressure receiver. A high level occurs in the vessel, producing a back flow to the condenser and raising head pressures.	3. Injury 4. Reactive maintenance				capacity to hold the entire ammonia inventory. 2. Petaluma Creamery refrigeration personnel have been trained to make sure that no single vessel is filled beyond 85%.
8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	3	C	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
9: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1, §12.6.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
10: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

2: Surge Drums

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. The surge drums are located above the ice builders which are inaccessible to vehicle traffic. 2. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
2: What if the back pressure regulator on the suction return	Actuator sticks in the open position causing pressures/temperatures to	1. Product damage 2. Reactive maintenance	2	3	C	1. Petaluma Creamery refrigeration personnel perform a daily

line fails? (ANSI/IIAR 7-2019 §10.3(1))	continue to drop, overcooling the ice builder.					refrigeration system inspection. Any deficiencies are corrected.
	Recommendation(s): It is recommended to equip each Ice Builder with temperature probes which provide continuous temperature monitoring and alarm capabilities if the temperature in the Ice Builder deviates outside of a predetermined range. **Priority** 3 **Responsible Person** Fernando Ortiz **Due Date** 03/01/2022 **Completed Date** **Related Events** No related events. **Resolution** **Linked Records**					
	Actuator sticks in the closed position causing pressures/temperatures to continue to rise, letting the room warm up.	1. Product damage 2. Reactive maintenance	2	3	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	Recommendation(s): It is recommended to equip each Ice Builder with temperature probes which provide continuous temperature monitoring and alarm capabilities if the temperature in the Ice Builder deviates outside of a predetermined range. **Priority** 3 **Responsible Person** Fernando Ortiz **Due Date** 03/01/2022 **Completed Date** **Related Events** No related events. **Resolution** **Linked Records**					
3: What if a section of line is isolated while containing liquid ammonia? (ANSI/IIAR 2-2014 Addendum A §15.6)	A valve group is not isolated properly causing liquid ammonia to become trapped between isolation, check and/or solenoid valves.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 2. Petaluma Creamery refrigeration personnel have been trained as to the hazards of anhydrous ammonia including the dangers of trapping liquid ammonia in pipes/equipment. 3. Valve groups are equipped with a provision for ammonia removal (service valve at the strainer) which provides a safe location to remove ammonia when isolating a valve group.
4: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)	An inadequate maintenance program allows the vessel insulation jacket, vapor barrier, or urethane foam to become damaged over time.	1. Death 2. Equipment damage 3. Low pressure liquid ammonia release 4. Injury	3	3	N	1. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith

						and a report of findings was prepared on 3/13/2019.

Recommendation(s):
The Ice Builder #2 Surge Drum is not insulated. It is recommended that the facility insulate the vessel to prevent excessive ice build up and external corrosion.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events
No related events.
Resolution
Linked Records

5: What if uncertified alterations/modifications are made to the vessel? (ANSI/IIAR 6-2019 §5.3.3(7))	A connection is cut into the vessel in the field that is not performed by an ASME certified welder negating the ASME certification stamp.	1. Death 2. Equipment damage 3. Injury 4. Low pressure liquid ammonia release	4	2	N	

Recommendation(s):
Ice builder 1 Surge drums 1 and 2 nameplates are not accessible because the nameplates are located under insulation. Expose the nameplates and obtain the associated manufacturer data reports.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events
No related events.
Resolution
Linked Records

6: What if system suction pressure rises above the relief pressure setting of the vessel? (ANSI/IIAR 7-2019 §10.3(1))	During the off-season the ambient temperature in the room rises above 85 degrees F causing the pressure in the vessel to exceed the relief valve set point of 150psig.	1. Death 2. High pressure vapor ammonia release 3. Injury	3	2	C	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. The system is operational year-round.
7: What if the operating level float switch fails? (ANSI/IIAR 2-2014 Addendum A §5.12.3)	The float switch fails in the activated position causing the liquid feed solenoid valve to continue to fill the vessel beyond its normal level.	1. Equipment damage 2. Reactive maintenance	2	3	C	1. The main suction accumulator is equipped with a high level float switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator. 2. The refrigeration system is equipped with a liquid transfer vessel which would transfer the excess liquid from the main suction accumulator to the high pressure receiver. 3. The refrigeration system is equipped with a main suction accumulator which would collect the excess liquid before allowing it to enter the compressors. 4. Petaluma Creamery refrigeration personnel perform a daily refrigeration system

						inspection. Any deficiencies are corrected. 5. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
	The float switch fails in the deactivated position causing the vessel to become empty.	1. Product damage 2. Reactive maintenance	2	3	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	Recommendation(s): It is recommended to equip each Ice Builder with temperature probes which provide continuous temperature monitoring and alarm capabilities if the temperature in the Ice Builder deviates outside of a predetermined range. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2022 **Related Events** No related events. **Resolution** **Linked Records**					
8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
9: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1, §12.6.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
10: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	2	N	
	Recommendation(s): Ice builder 1 Surge drums 1 and 2 nameplates are not accessible because the nameplates are located under insulation. Expose the nameplates and obtain the associated manufacturer data reports.					

Priority	**Responsible Person**	**Due Date**	**Completed Date**	
3	Fernando Ortiz	03/01/2021		
Related Events				
No related events.				
Resolution				
Linked Records				

3: Transfer Pump

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. The ammonia pump is located inside the machinery room which is restricted to authorized personnel only.
2: What if the pumps are improperly isolated? (ANSI/IIAR 2-2014 Addendum A §9.2.2)	Ammonia is trapped between the pump discharge isolation valve and check valve when the pump is isolated for maintenance.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 2. The ammonia pump is equipped with a pressure gauge, which provides the provision to purge ammonia between the pump isolation valve and check valves. 3. Petaluma Creamery refrigeration personnel have been trained in the facility ammonia line break procedure.
3: What if a pump seal fails? (ANSI/IIAR 7-2019 §7.3(1))	A maintenance program which neglects checking pump seals may result in a seal failing suddenly.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	2	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
4: What if there is an oil failure on the pump? (ANSI/IIAR 7-2019 §7.3(1))	The maintenance program neglects pump lubrication and the oil reservoir becomes dry causing the seal to fail suddenly.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	2	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and					

	cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
6: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping. 2. The ammonia pump is located inside the machinery room which is restricted to authorized personnel only.
7: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §9.4)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

4: Ceiling Suspended Evaporators

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. The ceiling suspended evaporators are installed above the racking system and protected from being impacted by stored product. 2. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
2: What if a fan blade is thrown, impacting the evaporator coil. (ANSI/IIAR 6-2019 Table 9.1 Inspection Item 'F')	The maintenance program neglects ceiling suspended evaporator fans. Consequently, a fan becomes loose/damaged and a thrown fan blade slices through the coil.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. Petaluma Creamery personnel perform fan maintenance annually.
3: What if the coils corrode from the inside out? (ANSI/IIAR 6-2019 Appendix B Air-Cooling Evaporator Checklist Item 'N', ANSI/IIAR 6-2019 Table 15.1 Testing Item 'A')	Coil isolators are not installed during initial system installation. Electrolysis caused by contact of aluminum with steel causes corrosion.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	2	C	1. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was

						performed by Jody Smith and a report of findings was prepared on 3/13/2019.
4: What if the coils corrode from the outside in? (ANSI/IIAR 6-2019 Appendix B Air-Cooling Evaporator Checklist Item 'N')	The use of sulfur dioxide or methyl bromide for fumigation of the product in the room results in acids that corrode aluminum.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	2	1	A	1. Periodic maintenance and cleaning is performed on the two evaporators. 2. There is no fumigation process at the facility that exposes the evaporators to harsh chemicals such as sulfur dioxide. 3. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
	Poor water quality is used for defrosting or cleaning the coil which accelerates coil corrosion.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	2	C	1. Water samples are taken and analyzed on a regular basis to ensure that the concentrations of corrosive elements are within safe levels.
5: What if an evaporator falls to the ground? (ANSI/IIAR 2-2014 Addendum A §5.11)	In December 2016, a facility in Central California experienced a catastrophic ammonia release when the roof collapsed during a rainstorm and two ceiling suspended evaporators fell to the floor.	1. Low pressure liquid ammonia release 2. Low pressure vapor ammonia release 3. Injury 4. Death	4	1	C	1. Petaluma Creamery hired Resource Compliance to perform a CalARP Seismic Assessment of the ammonia refrigeration equipment. The assessment was performed by Peter Thomas, P.E. and a report of findings was prepared on 9/30/19.
6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
7: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.

	employee or contractor is injured.					
8: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §11.2.3)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

5: Plate & Frame Heat Exchanger

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	2	N	1. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
	Recommendation(s): It was observed that there is forklift and hand truck traffic near the Glycol Heat Exchanger. It is recommended that the facility install barrier posts around the equipment to protect the Glycol Heat Exchanger from accidental impact from forklift traffic. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
2: What if plates are corroded from the inside out? (ANSI/IIAR 6-2019 Appendix B Heat Exchanger Checklist Item 'S', ANSI/IIAR 6-2019 Table 15.1 Testing Item 'A')	Improper cleaning procedure allows the plate and frame heat exchanger plates to come in contact with harsh chemicals which cause corrosion.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	1	A	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 2. Petaluma Creamery does not disassemble and clean the plate and frame heat exchanger plates on a routine basis.
3: What if a gasket leak develops? (ANSI/IIAR 7-2019 §9.3(1))	A gasket failure allows ammonia to mix with the glycol solution. Materials incompatible with ammonia become contaminated (brass valves, controls, etc.).	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	1	A	1. Glycol samples are taken and analyzed every six months to ensure that the concentration is correct.
4: What if the glycol pump fails while the heat exchanger is "ON"? (ANSI/IIAR 7-2019 §9.3(1))	Glycol ceases to flow through the plate and frame heat exchanger and is allowed to freeze, causing the plates to separate.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	1	A	1. Glycol samples are taken and analyzed every six months to ensure that the concentration is correct.

						2. The normal ammonia temperature in the heat exchanger is not capable of freezing the glycol. 3. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 4. The glycol concentration is 30%, which corresponds to a freeze point of 7°F which is well below the normal ammonia temperature.
5: What if the chiller is put through a CIP (clean-in-place) process while liquid ammonia is still present? (ANSI/IIAR 2-2014 Addendum A §15.3.8.2.3)	High temperature cleaners cause the liquid ammonia to quickly evaporate, creating an over-pressure event.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	3	2	C	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Relief valves are installed to protect the plate and frame heat exchanger from over-pressurization.
6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
7: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
8: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §11.4.3.1)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

6: Ice Builders

What If	Scenarios	Consequences	Safeguards

			Severity	Likelihood	Risk Rankings	
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
2: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
3: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
4: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §11.5.3)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.
5: What if ice builder pipes are subject to corrosion?	Corrosion could cause the pipe and/or valve integrity to degrade to the point that a hole develops.	1. Product damage 2. Injury	3	3	N	1. Water samples are taken and analyzed on a regular basis to ensure that the concentrations of corrosive elements are within safe levels. 2. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
	Recommendation(s): There is extensive corrosion associated with Ice Builder #1. It was discussed that the Ice Builder					

has been valved off from the refrigeration system and is not in operation, but it is recommended to completely cut and cap the Ice Builder from the refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

7: Main Suction Accumulator

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Injury 3. Low pressure liquid ammonia release 4. Reactive maintenance	4	1	C	1. The main suction accumulator is located inside the machinery room which is restricted to authorized personnel only.
2: What if the high level cutout float switch fails? (ANSI/IIAR 2-2014 Addendum A §8.4.9)	As the main suction accumulator is filling up, failure of this switch could cause overflow liquid to "slug" the compressors.	1. Equipment damage 2. Reactive maintenance	3	2	C	1. The refrigeration system is equipped with a liquid transfer vessel which would transfer the excess liquid from the main suction accumulator to the high pressure receiver. 2. The high level float switch is tested for proper operation periodically. The last test was performed on 7/17/2018.

Recommendation(s):

The high level float switch on the Suction Accumulator was last tested 7/17/2018. Ensure the Suction Accumulator high level float switch is tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

3: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)	An inadequate maintenance program allows the vessel insulation jacket, vapor barrier, or urethane foam to become damaged over time.	1. Death 2. Equipment damage 3. Injury 4. Low pressure liquid ammonia release	3	2	C	

Recommendation(s):

The Suction Accumulator and associated insulated piping is not adequately insulated. It is recommended to reinsulate the Suction Accumulator and associated piping with the appropriate vapor barrier, insulation, and jacketing that is rated for industrial refrigeration.

Priority	Responsible Person	Due Date	Completed Date
1	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

4: What if the vessel is undersized for the load on the system? (ANSI/IIAR 5-2013 §6.1.1)	The main suction accumulator is undersized causing gas velocities in the vessel to become so high that liquid is carried over to the compressors.	1. Equipment damage 2. Reactive maintenance	3	1	A	1. The Main Suction Accumulator has been in service since 1989 and has shown no indication of being undersized.
5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
6: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1, §12.6.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
7: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	

Recommendation(s):

Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Recommendation(s):

The Suction Accumulator nameplate is illegible due to corrosion on the nameplate. It is recommended that a concerted effort be made to clean the nameplate and obtain the associated manufacturer data report.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

8: Liquid Transfer Vessel

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. The liquid transfer vessel is located inside the machinery room which is restricted to authorized personnel only.
2: What if a check valve in a transfer line fails? (ANSI/IIAR 7-2019 §10.3(1))	The check valve between the main suction accumulator and the liquid	1. Equipment damage 2. Reactive maintenance	2	2	A	1. The main suction accumulator is equipped with a high level float

	transfer vessel fails allowing high pressure vapor to enter the main suction accumulator when a transfer is initiated. The liquid transfer vessel will cease to transfer liquid in this scenario.					switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	The check valve between the liquid transfer vessel and the high pressure receiver fails allowing high pressure vapor to fill the liquid transfer vessel at all times. The liquid transfer vessel will cease to transfer liquid in this scenario.	1. Equipment damage 2. Reactive maintenance	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The main suction accumulator is equipped with a high level float switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator.
3: What if a float switch on the liquid transfer vessel fails? (ANSI/IIAR 2-2014 Addendum A §5.12.3)	The float switch which activates liquid transfer fails causing the liquid transfer vessel to remain at the same pressure level at all times. The liquid transfer vessel will cease to transfer liquid in this scenario.	1. Equipment damage 2. Reactive maintenance	2	3	C	1. The main suction accumulator is equipped with a high level float switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
4: What if a section of line is isolated while containing liquid ammonia? (ANSI/IIAR 2-2014 Addendum A §15.6)	Ammonia is trapped between a liquid transfer vessel isolation valve and check valve when the liquid transfer vessel is isolated for maintenance.	1. Death 2. High pressure liquid ammonia release 3. Injury 4. Reactive maintenance	4	1	C	1. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297)
5: What if the 3-way solenoid valve fails? (ANSI/IIAR 7-2019 §10.3(1))	The 3-way solenoid fails open or closed causing the liquid transfer vessel to remain at the same pressure level at all times. The liquid transfer vessel will cease to transfer liquid in this scenario.	1. Equipment damage 2. Reactive maintenance	2	2	A	1. The main suction accumulator is equipped with a high level float switch which will shut the compressors off and initiate an alarm if the liquid level becomes too high in the main suction accumulator. 2. Petaluma Creamery refrigeration personnel perform a daily

						refrigeration system inspection. Any deficiencies are corrected.
6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
7: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1, §12.6.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
8: What if the equipment lacks a nameplate? (ANSI/IIAR-2 2014 Addendum A §12.4)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

9: Screw Compressors

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Equipment damage 3. High pressure vapor ammonia release 4. Injury 5. Reactive maintenance	4	1	C	1. The compressors are located inside the machinery room which is restricted to authorized personnel only.
	A swinging ladder breaks off a gauge or other sensitive instrument releasing ammonia.	1. Death 2. High pressure vapor ammonia release 3. Injury 4. Reactive maintenance	3	2	C	1. The compressors are located inside the machinery room which is restricted to authorized personnel only.
2: What if the compressor safety devices are not tested on a regular basis? (ANSI/IIAR 6-2019 Table 6.1 Testing Items 'A'-'D')	The maintenance program neglects compressor safety devices. A safety device (cut-out switch or pressure transducer) malfunctions which causes the compressor to operate in unsafe conditions, possibly leading to an ammonia release.	1. Death 2. High pressure vapor ammonia release 3. Injury 4. Reactive maintenance	3	1	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. The compressor safety devices (high pressure cutout, low pressure cutout, and oil pressure cutout) are tested for proper operation periodically. The last test was performed 6/20/2018.

Recommendation(s):

The compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts safety devices were last tested in 2018. Ensure that the compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts are tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

3: What if the lubrication for the compressor fails? (ANSI/IIAR 7-2019 §6.3(1))	The oil is not changed on a routine basis and degrades over time.	1. Equipment damage	2	3	C	
	Recommendation(s): The PHA team could not confirm when oil analysis was last performed on the compressors. Ensure that a maintenance schedule is developed and implemented for the compressor oil. **Priority** / **Responsible Person** / **Due Date** / **Completed Date** 3 / Fernando Ortiz / 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
	The oil level is not monitored. Gradual loss of oil leads to insufficient compressor lubrication.	1. Equipment damage 2. Reactive maintenance	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The compressors are equipped with oil level cutouts that will shut them down if the oil level is outside of the acceptable range.
	The coalescer gasket fails releasing large amounts of oil into the system.	1. Equipment damage 2. Reactive maintenance	2	2	A	1. The compressors are equipped with oil level cutouts that will shut them down if the oil level is outside of the acceptable range. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
4: What if wear and tear on the screw compressor shaft seal is not monitored? (ANSI/IIAR 7-2019 §6.3(1))	The maintenance program neglects compressor shaft seals which allows the seal drip rate to increase and eventually fail.	1. Death 2. High pressure vapor ammonia release 3. Injury 4. Reactive maintenance	3	1	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
5: What if the compressor is idle for an extended period of time and ammonia condenses in the oil separator? (IIAR 2-2014 Addendum A §8.4.2)	An oil heater failure combines with a leaky discharge check valve to allow ammonia to condense in the oil separator. When the compressor is started in this condition liquid ammonia will slug the coalescing element.	1. Equipment damage 2. Reactive maintenance	3	1	A	1. Each compressor is equipped with an oil heater to keep the ammonia and oil at a suitable temperature when the compressors are in 'Standby'. 2. All the compressors are equipped with a discharge check valve to prevent vapor from entering the separator when "OFF". 3. The compressors are equipped with oil temperature cutouts that will prevent start up and also shut it down if the oil temperature is outside of the acceptable range.

6: What if inappropriate entries are placed into the control panel? (ANSI/IIAR 2-2014 Addendum A §16.1.5)	An operator changes a control set-point to a level beyond the design conditions.	1. Death 2. Equipment damage 3. High pressure vapor ammonia release 4. Injury	4	1	C	1. The compressor set points are restricted by range limits to prevent unsafe settings. 2. The panel to change compressor set-points is controlled locally at the compressor panel in the machinery room which is restricted to authorized personnel only.
7: What if the compressor discharge valve is left closed? (Title 8 CCR §3314)	After performing maintenance, an operator forgets to open the discharge valve, leading to an increase in discharge pressure.	1. Death 2. High pressure vapor ammonia release 3. Injury 4. Reactive maintenance	2	2	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Petaluma Creamery has developed and implemented a lockout/tagout program to protect workers from this type of hazard. 3. The compressors are equipped with pressure relief valves which protect the equipment from over-pressurization. 4. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts.
8: What if liquid ammonia is present in the suction line? (ANSI/IIAR 2-2014 Addendum A §8.4.2)	System conditions allow liquid to condense in the suction drop to the compressor. When turned on, liquid slugs are drawn into the compressor.	1. Equipment damage	3	1	A	1. The refrigeration system is equipped with a liquid transfer vessel which would transfer the excess liquid from the main suction accumulator to the high pressure receiver. 2. Petaluma Creamery has an operating procedure for safely operating a compressor.
9: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
10: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
11: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §8.3.1)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

10: Evaporative Condenser

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	4	1	C	1. The evaporative condenser is located on the machinery room roof which is inaccessible to vehicular traffic.
2: What if non-condensables are not purged out of the system? (ANSI/IIAR 2-2014 Addendum A §5.8)	Manual purging is not performed when needed allowing discharge pressures to rise. If this goes on unnoticed, it will cause compressors to shut off due to high pressure and/or a relief valve to lift.	1. Death 2. High pressure vapor ammonia release 3. Injury 4. Reactive maintenance	3	2	C	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 3. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 4. The compressors are equipped with pressure relief valves which protect the equipment from over-pressurization. 5. Petaluma Creamery refrigeration system is equipped with an auto-purger which negates the need to purge non-condensables manually.
3: What if an accident occurs while manually purging the system? (ANSI/IIAR 7-2019 §14.2)	Manual purging requires opening up the system. If an operator is careless, opens the wrong valve, or lets a hose go wild, ammonia could be released.	1. Death 2. High pressure liquid ammonia release 3. Injury	4	1	C	1. Petaluma Creamery refrigeration system is equipped with an auto-purger which negates the need to purge non-condensables manually.
4: What if the condenser fans fail? (ANSI/IIAR 7-2019 §8.3(1))	The maintenance program neglects condenser fans. During operation, a condenser fan fails suddenly.	1. Equipment damage 2. Reactive maintenance	1	3	A	1. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 3. The condenser is equipped with multiple condenser fans, which allows the condenser to continue to operate when

						only one condenser fan fails. 4. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting.
5: What if there is insufficient condenser cooling water? (ANSI/IIAR 7-2019 §8.3(1))	Condenser demand float sticks closed causing the water basin to dry up allowing the discharge pressure to rise.	1. Reactive maintenance	1	3	A	1. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 3. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting.
	Condenser water pump goes offline allowing the discharge pressure to rise.	1. Reactive maintenance	1	4	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 3. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting.
	Condenser spray nozzles become plugged allowing the discharge pressure to rise.	1. Reactive maintenance	3	3	N	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 3. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts.

Recommendation(s):

The facility has just changed their refrigeration contractor to Alliance Industrial Refrigeration, and it is unclear how the inspection, test, and maintenance activities related to the ammonia refrigeration system are being addressed. It is recommended to develop a mechanical integrity program for the ammonia refrigeration system and distinguish responsibility of activities between the facility and contractor.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

	Resolution **Linked Records**					
	In August 2018, a California facility experienced a prolonged downtime when installing an eyewash and safety shower. The facility shut down the water supply in order to install the eyewash and safety shower, but did not realize that the condenser sump was supplied from the same pipe. The water loss in the condenser resulted in elevated discharge pressure and prolonged downtime while the eyewash and safety shower was being installed.	1. Reactive maintenance	2	2	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 3. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
6: What if there is no water-treatment for the condenser makeup water supply? (ANSI/IIAR 7-2019 §8.3(1))	No water treatment leads to scale build-up on the condenser tubes reducing the capacity/efficiency of the condenser.	1. Equipment damage	3	1	A	1. Petaluma Creamery uses a qualified water treatment company, Garrett-Callahan, to oversee this type of work.
	Existing water treatment runs out of chemical and/or breaks down without anyone noticing, leading to scale buildup on the condenser tubes.	1. Equipment damage	2	2	A	1. Routine maintenance is performed on the condensers. 2. Petaluma Creamery uses a qualified water treatment company, Garrett-Callahan, to oversee this type of work.
7: What if a condenser valve is left closed? (ANSI/IIAR 7-2019 §14.2)	After performing maintenance, an operator forgets to open the drain valve, leading to an increase in discharge pressure.	1. High pressure liquid ammonia release 2. Death 3. High pressure vapor ammonia release 4. Reactive maintenance	3	1	A	1. Petaluma Creamery has developed and implemented a lockout/tagout program to protect workers from this type of hazard. 2. The compressors are equipped with high pressure cutouts that will shut them down before a relief valve lifts. 3. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting.
8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events**					

	No related events. **Resolution** **Linked Records**					
9: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
	Recommendation(s): There is no permanent access to the top of the condenser for facility personnel and contractors to safely perform maintenance activities. It is recommended that a permanent ladder be installed to provide safe access at the top of the condenser. **Priority** 2 **Responsible Person** Fernando Ortiz **Due Date** 09/01/2021 **Completed Date** **Related Events** No related events. **Resolution** **Linked Records**					
10: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §10.3.3)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

11: Piping

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if ammonia pipes are isolated while containing liquid ammonia? (ANSI/IIAR 2-2014 Addendum A §15.6.1)	Proper procedures to isolate pipes and equipment are not followed causing liquid to become trapped and leading to a hydrostatic failure and release of ammonia.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	4	1	C	1. Petaluma Creamery refrigeration personnel have been trained as to the hazards of anhydrous ammonia including the dangers of trapping liquid ammonia in pipes/equipment. 2. Petaluma Creamery has developed and implemented a lockout/tagout program to protect workers from this type of hazard.
2: What if refrigerant pipes are subject to corrosion? (ANSI/IIAR 6-2019 Table 11.1 Inspection Item 'A')	Pipe insulation fails allowing corrosion under insulation (CUI) to occur and leading to pipe failure.	1. Death 2. Equipment damage 3. Injury 4. Low pressure liquid ammonia release 5. Reactive maintenance	3	2	C	1. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
	Recommendation(s): Although much of the ammonia equipment, piping, and valves located in the machinery room have					

	been cleaned and painted, there is an extensive amount of outdoor and cooler room ammonia equipment, piping, and valves that need to be cleaned and painted to arrest corrosion. Ensure that all outdoor and cooler room equipment, pipe, and valves are cleaned and painted. **Priority** **Responsible Person** **Due Date** **Completed Date** 2 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
	Water from a leaky condenser pan drips on an unprotected refrigerant pipe causing accelerated corrosion.	1. Equipment damage 2. High pressure liquid ammonia release 3. Reactive maintenance	3	2	C	
	Recommendation(s): Although much of the ammonia equipment, piping, and valves located in the machinery room have been cleaned and painted, there is an extensive amount of outdoor and cooler room ammonia equipment, piping, and valves that need to be cleaned and painted to arrest corrosion. Ensure that all outdoor and cooler room equipment, pipe, and valves are cleaned and painted. **Priority** **Responsible Person** **Due Date** **Completed Date** 2 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
3: What if there are sections of pipe that are subject to excess vibration? (ANSI/IIAR 2-2014 Addendum A §13.4.2)	Compressor operation generating harmonic frequencies causes piping to vibrate and crack at weak points.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	3	2	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. Petaluma Creamery hired Resource Compliance to perform a CalARP Seismic Assessment of the ammonia refrigeration equipment. The assessment was performed by Peter Thomas, P.E. and a report of findings was prepared on 9/30/19.
4: What if there are sections of pipe that are subject to hammering? (ANSI/IIAR 2-2014 Addendum A §13.4.2)	A solenoid valve at the end of a long line generates excessive hammering when it shuts off causing a relief valve to pulse open or a pipe to rupture.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	4	1	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
5: What if there are sections of pipe that are not supported according to the good engineering practice? (ANSI/IIAR 2-2014 Addendum A §13.4.1)	Pipe hangers are too far apart. Pipe sags and leaks at nearest flange fitting, releasing ammonia.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	3	2	C	1. Petaluma Creamery hired Resource Compliance to perform a CalARP Seismic Assessment of the ammonia refrigeration equipment. The assessment was performed by Peter Thomas, P.E. and a report of findings was prepared on 9/30/19.
6: What if pipes are not	An emergency responder	1. Delayed emergency	2	3	C	

properly labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.6, §6.6.3)	isolates the wrong pipe, compounding the seriousness of the situation.	response 2. Incorrect emergency response				

Recommendation(s):

Although much of the ammonia equipment, piping, and valves located in the machinery room have been cleaned and painted, there is an extensive amount of outdoor and cooler room ammonia equipment, piping, and valves that need to be cleaned and painted to arrest corrosion. Ensure that all outdoor and cooler room equipment, pipe, and valves are cleaned and painted.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

7: What if improper pipe/fitting materials are used in the system construction? (ANSI/IIAR 2-2014 Addendum A §13.2)	Standard black pipe (Type F) or galvanized fittings are not designed to withstand high pressure and may fail during operation.	1. Death 2. High pressure liquid ammonia release 3. High pressure vapor ammonia release 4. Injury	4	1	C	1. All refrigeration contractors are required to be qualified through the facility CalARP program. 2. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
8: What if the piping is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1, §13.3.7)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.

12: Valves

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if a valve is over tightened? (ANSI/IIAR 6-2019 §A.5.6.5.1)	Operator/Contractor uses an oversized cheater bar or pipe wrench to tighten down a valve breaking seal on bonnet.	1. High pressure liquid ammonia release	3	2	C	1. Petaluma Creamery personnel have been trained to not use cheater bars on ammonia valves.

Recommendation(s):

The facility has just begun to work with a new refrigeration contractor, Alliance Industrial Refrigeration. It is recommended the facility obtain a contractor qualification packet for Alliance

	Industrial Refrigeration. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
2: What if critical valves not mentioned elsewhere are not labeled or easily identified? (ANSI/IIAR 2-2014 Addendum A §5.14.4, §13.3.7)	During an emergency a responder cannot match valve tags with P&IDs in order to isolate a component or section of line that is releasing ammonia.	1. Delayed emergency response	2	1	A	1. Each valve in the emergency control box is clearly labeled. 2. The high pressure receiver is equipped with a single "King Valve" that is clearly labeled.
3: What if debris prevents a valve from sealing? (ANSI/IIAR 2-2014 Addendum A §13.3.6)	Welding slag or other debris keeps a valve from sealing properly which prevents a section of line from being isolated when required.	1. Delayed emergency response	2	3	C	
	Recommendation(s): The facility has just changed their refrigeration contractor to Alliance Industrial Refrigeration, and it is unclear how the inspection, test, and maintenance activities related to the ammonia refrigeration system are being addressed. It is recommended to develop a mechanical integrity program for the ammonia refrigeration system and distinguish responsibility of activities between the facility and contractor. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
	In May 2017, an accidental release of ammonia occurred at a facility when a contract employee cut into a pipe containing ammonia. The pipe was believed to have been pumped down at the time. (https://goo.gl/ChMEcr)	1. High pressure liquid ammonia release 2. Injury 3. Death	3	2	C	1. Petaluma Creamery has developed and implemented a lockout/tagout program to protect workers from this type of hazard.
4: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §6.3.3, §13.3.7)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.

13: Relief Valves

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the preventative maintenance program for relief valves is insufficient or non-existent? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q)	The maintenance program neglects pressure relief valves. A relief valve that is not replaced every five (5) years is more likely to fail (not lift during over-	1. High pressure vapor ammonia release	3	1	A	1. All relief valves were installed in August and October of 2015.

	pressurization or lift at a pressure below it's set-pressure) **Recommendation(s):** The facility has just changed their refrigeration contractor to Alliance Industrial Refrigeration, and it is unclear how the inspection, test, and maintenance activities related to the ammonia refrigeration system are being addressed. It is recommended to develop a mechanical integrity program for the ammonia refrigeration system and distinguish responsibility of activities between the facility and contractor. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**						
2: What if a set pressure of a relief valve is more than the design pressure of the equipment it is protecting? (ANSI/IIAR 2-2014 Addendum A §15.2.7.1)	During operation the system pressure rises above the allowable pressure of the equipment, but the relief valve does not lift because the set-pressure is too high. Under these conditions, the equipment could rupture.	1. High pressure liquid ammonia release	4	1	C	1. All relief valves have a set pressure equal to or less than the MAWP of the equipment that the relief valve protects.
3: What if a relief valve capacity is too low? (ANSI/IIAR 2-2014 Addendum A §15.3.8.1)	During operation an overpressure condition occurs. The relief valve lifts, but cannot meet the relief capacity demand. Under these conditions, the equipment could rupture.	1. High pressure liquid ammonia release	4	1	C	1. All relief valves have capacity which meets or exceeds the requirement of ANSI/IIAR 2-2014 Addendum A §15.3.8.
	Recommendation(s): The Ammonia Refrigeration System Relief System Analysis completed by APCCO on July 22, 2019 reveals several instances the relief system is deficient: Suction Accumulator, Condenser 1, Condenser 2, etc. It is recommended the facility update their relief system to properly upsize the relief vent piping and change the relief valves for proper sizing and capacity when the relief valves are changed out in August 2020. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**						
4: What if a relief valve lifts below its set-pressure? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q)	Vibration, incorrect design, weakened spring, or failure of valve seat material allows the relief valve to lift at a pressure below its set-pressure.	1. High pressure vapor ammonia release	3	2	C	1. All relief valves were installed in August and October of 2015. 2. All relief valves terminate into the ammonia diffusion tank. The termination pipe is installed in such a way as to prevent employees from being impacted by a release or water from accumulating in the relief piping.
5: What if a relief valve fails to lift at/above its set-pressure? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q)	The maintenance program neglects pressure relief valves. A relief valve that is not replaced every five (5) years is more likely to fail (not lift during over-	1. High pressure liquid ammonia release	3	2	C	1. All relief valves were installed in August and October of 2015. 2. All relief valves terminate into the ammonia

	pressurization or lift at a pressure below it's set-pressure)					diffusion tank. The termination pipe is installed in such a way as to prevent employees from being impacted by a release or water from accumulating in the relief piping.
6: What if liquid accumulates in the relief valve piping? (ANSI/IIAR 2-2014 Addendum A §15.5.1, §A.15.5.1.5)	Rain/condensate in the relief vent piping corrodes the pressure relief valves. Corrosion causes premature lifting of pressure relief valve.	1. High pressure vapor ammonia release	3	1	A	1. All relief valves terminate into the ammonia diffusion tank. The termination pipe is installed in such a way as to prevent employees from being impacted by a release or water from accumulating in the relief piping.
7: What if a relief valve lifts and no follow-up action is taken? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q))	After a relief valve has lifted, it may not re-seat correctly. This can lead to the relief valve lifting again at a pressure below its set-pressure.	1. High pressure vapor ammonia release	3	2	C	1. Petaluma Creamery replaces any relief valve immediately after they become aware that the valve has lifted.
8: What if there is a closed stop valve before/after a relief valve? (ANSI/IIAR 2-2014 Addendum A §15.4.1)	During an over-pressurization event, a closed stop valve will prevent the relief valve from lifting which could lead to equipment rupture.	1. High pressure liquid ammonia release	4	1	C	1. There are no stop valves installed before/after any of the relief valves. 2. Petaluma Creamery hired APCCO to perform a 5-yr Mechanical Integrity Audit of the ammonia refrigeration equipment. The 5-yr Mechanical Integrity Audit was performed by Jody Smith and a report of findings was prepared on 3/13/2019.
9: What if a relief valve discharges into piping that is not vented to the atmosphere? (ANSI/IIAR 2-2014 Addendum A §15.3.7)	When a pressure relief valve discharges into piping or equipment that is connected to another portion of the system, it changes the set-point of the pressure relief valve by the downstream pressure. If not accounted for, this could lead to equipment rupture.	1. High pressure liquid ammonia release	3	1	A	1. There are no relief valves installed which discharge back into the refrigeration system.
10: What if there is no relief valve on a piece of equipment that requires a relief valve? (ANSI/IIAR 2-2014 Addendum A §15.3)	During an over-pressurization event, equipment may rupture.	1. High pressure liquid ammonia release	4	1	C	1. All facility ASME pressure vessels, heat exchangers, and positive displacement compressors are equipped with relief valves.
11: What if relief valve discharge piping is not terminated correctly? (ANSI/IIAR 2-2014 Addendum A §15.4, §15.5)	A pressure relief valve terminated incorrectly releases ammonia and exposes a nearby worker.	1. Death 2. Injury	4	1	C	1. All relief valves terminate into the ammonia diffusion tank. The termination pipe is installed in such a way as to prevent employees from being impacted by a release or water from accumulating in the relief piping.

12: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3, §15.2.8)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
13: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §15.2.4)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
14: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §15.2.8)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

14: Ammonia Diffusion Tank

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the tank is low on water or is completely empty? (ANSI/IIAR 2-2014 Addendum A §15.5.3)	The tank level is not monitored and the level drops so that when a release occurs there is not enough water to adsorb the ammonia.	1. Death 2. High pressure vapor ammonia release 3. Injury	3	1	A	1. The water level in the diffusion tank and the pH of the water are checked monthly. 2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
2: What if the tank develops a leak? (ANSI/IIAR 2-2014 Addendum A §15.5.3)	The maintenance program neglects ammonia diffusion tank corrosion leading to a diffusion tank leak.	1. Aqueous ammonia release 2. Equipment damage 3. Reactive maintenance	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
3: What if the water in the diffusion tank becomes saturated with ammonia? (ANSI/IIAR 2-2014 Addendum A §15.5.3)	A relief valve lifts, but the condition of the water is such that there is not enough water to adsorb the ammonia.	1. Death 2. High pressure vapor ammonia release 3. Injury	3	1	A	1. The water level in the diffusion tank and the pH of the water are checked monthly. 2. The ammonia diffusion tank is equipped with a vent line sensor to alert refrigeration personnel in the event of a discharge into the tank.
4: What if the release sensor in the relief discharge piping fails? (ANSI/IIAR 6-2019 Table 12.3 Testing Item A)	A relief valve lifts, discharging ammonia into the diffusion tank. Due to the lack of odor, the release goes undetected.	1. Insufficient ammonia inventory	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The water level in the diffusion tank and the pH

						of the water are checked monthly.
5: What if brass water valves are used on the ammonia diffusion tank? (ANSI/IIAR 2-2014 Addendum A §5.7.2.2)	Aqueous ammonia created in the tank upon a release corrodes copper and brass materials. A brass drain valve corrodes and develops a leak.	1. Aqueous ammonia release 2. Equipment damage 3. Reactive maintenance	2	1	A	1. The water level in the diffusion tank and the pH of the water are checked monthly.
6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
7: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
8: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §5.14.5.1)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

15: Auto-Purger

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury 5. Reactive maintenance	4	1	C	1. The auto-purger is located inside the machinery room which is restricted to authorized personnel only.
2: What if the auto-purger drain pipe becomes plugged? (ANSI/IIAR 2-2014 Addendum A §5.8)	In October 2012, two technicians were injured when they were splashed by aqueous ammonia. One of the contributing causes of the accident was that the auto-purger drain pipe had become completely plugged.	1. Aqueous ammonia release 2. Death 3. Injury	4	1	C	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
3: What if there is insufficient cooling of the purge system?	The ammonia liquid feed to the purger is inadequate	1. Death	3	2	C	1. the auto purger has been in service several

(ANSI/IIAR 2-2014 Addendum A §5.8)	which prevents the system from removing ammonia from the purge stream. The system purges a stream of ammonia to the water bubbler, saturating the bubbler and resulting in an ammonia release.	2. High pressure vapor ammonia release 3. Injury				years and has shown no indication of insufficient cooling.
4: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
5: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
6: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §5.14.5.1)	Equipment lacking a nameplate may have been shop fabricated or manufactured in a manner which is not consistent with good engineering practice.	1. Equipment damage 2. High pressure liquid ammonia release 3. Injury 4. Death	4	1	C	1. Most pressure vessels and refrigeration system components are equipped with legible nameplates supplied by the equipment manufacturer.

16: Emergency Ventilation

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the machinery room is not equipped with emergency exhaust ventilation? (ANSI/IIAR 2-2014 Addendum A §6.14.7)	A leak develops in the machinery room and there are no ventilation fans to help mitigate ammonia vapor.	1. Death 2. Injury	2	2	A	1. The machinery room ventilation fan is capable of moving 12,200 CFM of air which exceeds the 30ACH requirement of ANSI/IIAR 2-2014 Addendum A §6.14.7.1.
2: What if an "Emergency Ventilation Switch" is not installed? (ANSI/IIAR 2-2014 Addendum A §6.12.2)	During an emergency there is no single switch available to help mitigate the leak. This could lead to high concentrations of ammonia in the machinery room.	1. Delayed emergency response	3	2	C	1. The ventilation fan runs continuously and can be stopped at the fan motor breaker panel or the emergency ventilation switch outside the machinery room.
	Recommendation(s): The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the					

	E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
3: What if the "Emergency Ventilation Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.2)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.
	Recommendation(s): The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
4: What if the "Emergency Ventilation Switch" does not work? (ANSI/IIAR 2-2014 Addendum A §6.14.8)	During an emergency, the "Emergency Ventilation Switch" does not work and the ventilation fans are unable to exhaust the ammonia from the machinery room.	1. Delayed emergency response 2. Fire 3. Injury 4. Death	2	2	A	1. The emergency ventilation switch is tested for proper operation periodically. The last test was performed on 7/3/2018.
5: What if the "Emergency Ventilation Switch" is not located where it can easily be activated? (ANSI/IIAR 2-2014 Addendum A §6.12.2)	During an emergency, an emergency responder cannot find the switch as needed to make the proper response.	1. Delayed emergency response 2. Fire 3. Injury	2	2	A	1. The emergency ventilation switch is located outside the machinery room in the maintenance shop.
	Recommendation(s): The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**					
6: What if the ventilation fans discharge to a location that can be harmful to people in the area? (ANSI/IIAR 2-2014 Addendum A §6.14.3)	The discharge from the fans exposes plant personnel to ammonia-laden air.	1. Injury	3	2	C	1. The discharge from the machinery room ventilation fan(s) is on the roof and at least 20 ft from a property line or building opening.
7: What if the ventilation fans do not provide adequate airflow in an emergency? (ANSI/IIAR 2-2014 Addendum A §6.14.7.1)	During an emergency even though the fan(s) is running, the ammonia concentration inside the machinery room is able to reach a flammable concentration.	1. Fire 2. Injury 3. Death	4	1	C	1. The machinery room ventilation fan is capable of moving 12,200 CFM of air which exceeds the 30ACH requirement of ANSI/IIAR 2-2014 Addendum A §6.14.7.1.

17: Emergency Stop Switch

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if an employee activates the "Emergency Stop Switch"? (ANSI/IIAR 2-2014 Addendum A §6.12.1)	The switch is activated when the "emergency" is out in the plant on the low-side and not in the machinery room. Compressors are not available to help lower pressures and reduce amount of ammonia released.	1. Death 2. Delayed emergency response 3. Injury	3	1	A	1. Petaluma Creamery refrigeration personnel are trained on the proper use of the emergency refrigeration switch.
2: What if the "Emergency Stop Switch" does not work? (ANSI/IIAR 2-2014 Addendum A §6.12.1)	During a leak involving the high pressure portion of the refrigeration system, an employee activates the "Emergency Refrigeration Switch", but it does not work.	1. Delayed emergency response	3	2	C	1. The e-stop is tested for proper operation periodically. The last test was performed on 7/3/2018.
	Recommendation(s): The e-stop button was last tested 7/3/2018. Ensure the emergency stop button is tested and perform subsequent tests annually. **Priority** 3 **Responsible Person** Fernando Ortiz **Due Date** 09/01/2020 **Completed Date** **Related Events** No related events. **Resolution** **Linked Records**					
3: What if an "Emergency Stop Switch" is not installed? (ANSI/IIAR 2-2014 Addendum A §6.12.1)	During an emergency there is no single switch available to help mitigate the leak. This could lead to a prolonged leak.	1. Delayed emergency response	4	1	C	1. The machinery room is equipped with an emergency refrigeration switch (e-stop) outside the principal machinery room door, which is located in the maintenance room.
4: What if the "Emergency Stop Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.1)	During an emergency, an emergency responder cannot identify the system components to make the proper response.	1. Delayed emergency response	3	2	C	1. The emergency refrigeration switch (e-stop) is labeled.
	Recommendation(s): The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly. **Priority** 3 **Responsible Person** Fernando Ortiz **Due Date** 03/01/2021 **Completed Date** **Related Events** No related events. **Resolution** **Linked Records**					
5: What if the "Emergency Stop Switch" is not accessible? (ANSI/IIAR 2-2014 Addendum A §6.12.1)	A leak develops in the machinery room and the responders are not able to access the "Emergency Stop Switch" because it is located inside the machinery room.	1. Delayed emergency response 2. Injury	4	2	N	1. The machinery room is equipped with an emergency refrigeration switch (e-stop) outside the principal machinery room door, which is located in the maintenance room.

	Recommendation(s): The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 03/01/2021 **Related Events** No related events. **Resolution** **Linked Records**

18: Emergency Control Box

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)	A forklift driver accidentally hits this piece of equipment.	1. High pressure vapor ammonia release	4	1	C	1. The emergency control box is protected by barrier posts. 2. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
2: What if an employee uses the emergency control box to dump ammonia from the system?	During an emergency situation an authorized person opens the high-side and/or low-side refrigerant dump valves.	1. Death 2. High pressure vapor ammonia release 3. Injury	4	1	C	1. Petaluma Creamery operators have been trained as to the hazards of anhydrous ammonia and have been instructed not to use the emergency control box.
3: What if an employee uses the emergency control box to equalize pressure between the high and low portions of the system?	The equalizer valve is opened allowing high pressure vapor to enter the low side of the system. This increases the potential for a relief valve to lift.	1. Death 2. High pressure vapor ammonia release 3. Injury	2	2	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Petaluma Creamery operators have been trained as to the hazards of anhydrous ammonia and have been instructed not to use the emergency control box.
4: What if the emergency control box is not clearly labeled? (ANSI/IIAR 2-2014 Addendum A §13.3.7)	Emergency response personnel cannot find the emergency control box easily, or are unaware of its existence delaying a response.	1. Delayed emergency response	2	1	A	1. The emergency control box is clearly labeled.
5: What if the valves in the emergency control box are not clearly labeled? (ANSI/IIAR 2-2014 Addendum A §13.3.7)	An emergency responder opens up the wrong valve compounding the seriousness of the situation.	1. Death 2. High pressure vapor ammonia release 3. Injury	3	1	A	1. Petaluma Creamery operators have been trained as to the hazards of anhydrous ammonia and have been instructed

						not to use the emergency control box. 2. Each valve in the emergency control box is clearly labeled.
6: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §13.3.7)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.

19: Ammonia Detection

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if the ammonia detection does not work? (ANSI/IIAR 2-2014 Addendum A §17.3)	The maintenance program neglects the ammonia detection devices and an ammonia leak develops.	1. Delayed emergency response	3	3	N	
	Recommendation(s): The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A. **Priority** **Responsible Person** **Due Date** **Completed Date** 1 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
2: What if ammonia detection is not installed? (ANSI/IIAR 2-2014 Addendum A §17.1)	During an ammonia leak there is no notification of the leak. This could lead to a prolonged leak.	1. Delayed emergency response	3	1	A	
	Recommendation(s): The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A. **Priority** **Responsible Person** **Due Date** **Completed Date** 1 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
3: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §17.6)	During an ammonia leak, an employee may not be able to identify what the notification is for.	1. Delayed emergency response	3	3	N	
	Recommendation(s): The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A. **Priority** **Responsible Person** **Due Date** **Completed Date** 1 Fernando Ortiz 09/01/2020					

	Related Events No related events. **Resolution** **Linked Records**					
4: What if the ammonia detection is not installed in a place where ammonia would accumulate? (ANSI/IIAR 2-2014 Addendum A §17.4)	The ammonia detectors are installed near ground level. When a leak develops the ammonia rises toward the ceiling and is not detected.	1. Delayed emergency response 2. Injury	2	1	A	1. Ammonia detectors are installed in the following locations; Machinery Room, Cold Box, and Relief Vent Line, which is where leaks are likely to develop.
5: What if the ammonia detection does not automatically activate the emergency exhaust ventilation system? (ANSI/IIAR 2-2014 Addendum A §6.13.2.3)	An ammonia leak occurs in the machinery room and the ammonia detection does not activate the ventilation fans, allowing the ammonia concentration to reach a dangerous concentration level.	1. Fire	3	3	N	
	Recommendation(s): The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A. **Priority** **Responsible Person** **Due Date** **Completed Date** 1 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
6: What if the ammonia detection is not set at the correct ppm? (ANSI/IIAR 2-2014 Addendum A §17.7)	An employee raises the ammonia detection set point while working on the system and does not lower the set point back to 25 ppm when finished.	1. Injury	2	3	C	
	Recommendation(s): The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A. **Priority** **Responsible Person** **Due Date** **Completed Date** 1 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					

20: Computer Controls

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if an operator is not sufficiently trained in the use of the computer system? (ANSI/IIAR 2-2014 Addendum A §16.1.5)	On August 23, 2010, 32,000 lbs of ammonia was released during a leak from a refrigeration system. One of the contributing causes	1. Reactive maintenance	2	2	A	1. Petaluma Creamery refrigeration personnel are trained in the use of the refrigeration controls.

	of the release was an operator incorrectly resetting the control system when it should not have been. [https://goo.gl/H0Rkd2]					2. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	The operator incorrectly enters set point data for low temperature safety alarms.	1. Product damage	2	2	A	1. Petaluma Creamery refrigeration personnel are trained in the use of the refrigeration controls. 2. The compressor set points are restricted by range limits to prevent unsafe settings.
2: What if a sensor fails, or a fuse blows, without operator knowledge? (ANSI/IIAR 6-2019 §5.3.6.1)	The computer screen reads that a solenoid valve is operating correctly when in fact it has failed.	1. Product damage	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
	A temperature sensor is out of calibration and reads that a room is at the set point when it is not.	1. Product damage	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
3: What if there is no control/sensor at a critical point to provide input to the computer? (ANSI/IIAR 2-2014 Addendum A §16.1.2)	An operator relies only on the computer for information and misses developing problems such as a leaking shaft seal.	1. High pressure vapor ammonia release	3	1	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
4: What if an unauthorized person gains access to the controls? (ANSI/IIAR 2-2014 Addendum A §16.1.5)	A "hacker" gains entry by modem and enters numbers at random.	1. Product damage	3	1	A	1. The compressors are equipped with "local" cutouts which will shut them off. 2. The refrigeration controls are not accessible over the internet.
	The computer controls are not password protected allowing a critical set point to be adjusted by an unauthorized person.	1. Product damage	3	1	A	1. The compressors are equipped with "local" cutouts which will shut them off.
5: What if there is a programming error? (ANSI/IIAR 5-2013 §7.15.3)	An anomaly in the program allows the defrost water solenoid to activate while the fans are still on which carries water out into the room.	1. Product damage	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected. 2. The refrigeration system is controlled by compressor panels, thermostats, and relay switches. There is no PLC/computer control.
6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)	During an emergency, an emergency responder cannot identify the system	1. Delayed emergency response	2	2	A	1. Most critical pipe, valves, equipment, and controls are clearly labeled.

	components to make the proper response.					
7: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	While attempting to access a difficult to reach piece of equipment to perform maintenance or emergency repairs, an employee or contractor is injured.	1. Delayed emergency response 2. Injury	3	1	A	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.

21: External Events

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if an earthquake occurs at the facility?	Equipment supports buckle or break causing pipe to rupture.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. Petaluma Creamery hired Resource Compliance to perform a CalARP Seismic Assessment of the ammonia refrigeration equipment. The assessment was performed by Peter Thomas, P.E. and a report of findings was prepared on 9/30/19.
2: What if an aircraft crashes into the facility?	An airplane malfunctions and crashes into the high pressure receiver.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations.
3: What if a drought occurs?	In the event of a drought, the condensers will not have sufficient water, leading to increased system pressures.	1. Inefficient operation	1	3	A	1. A drought would affect the products being refrigerated before it would affect the refrigeration system.
4: What if flooding occurs at the facility?	During a flood, the operator cannot access critical ammonia equipment due to high water levels.	1. Delayed emergency response	1	2	A	1. Petaluma Creamery is not in a location where heavy flooding is likely.
5: What if high winds occur at the facility?	During a windstorm, a pipe breaks releasing ammonia.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	2	2	A	1. The ammonia refrigeration process is not located in an area where high winds are a threat or concern.
6: What if there is a fire onsite?	A fire starts in the engine room and weakens system components leading to an ammonia release. When the ammonia concentration is between 15-26% (by volume) it can be extremely flammable.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. The machinery room is equipped with a ventilation system to help reduce the ammonia concentration if a leak were to occur inside the machinery room.
7: What if the facility is covered	During dense fog, a forklift	1. High pressure liquid	4	1	C	1. Petaluma Creamery

in dense fog?	driver crashes into a sensitive ammonia vessel.	ammonia release 2. Death 3. Equipment damage 4. High pressure liquid ammonia release				personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers).
8: What if a wasp nest is present near the ammonia equipment?	A wasp nest located near a sensitive piece of equipment or an access ladder can prevent a technician from being able to perform necessary work.	1. Delayed emergency response	2	3	C	1. Petaluma Creamery has contracted with a pest control company, Ecolab, to remove pests periodically.
9: What if the temperature drops below freezing?	If the temperature drops below freezing, water pipes can break causing the condenser to lose its water supply.	1. Equipment damage 2. Reactive maintenance	1	3	A	1. Temperatures rarely reach freezing temperatures for prolonged periods of time. 2. Water pipes can be quickly repaired by facility personnel.
10: What if a severe hailstorm passes over the facility?	A severe hailstorm can cause damage to process equipment.	1. Equipment damage	1	3	A	1. The design and construction of equipment can withstand a severe hailstorm.
11: What if the facility experiences high temperatures?	High ambient temperatures lead to elevated head pressures. If safety devices don't function correctly or relief valves malfunction, this could lead to an ammonia release related to over-pressurization.	1. Death 2. High pressure vapor ammonia release 3. Injury	1	4	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. The system has been designed to operate during times of year that experience high ambient temperatures.
12: What if there is an industrial accident at a nearby facility?	If a nearby facility has a chemical release it can lead employee/community panic, disrupting facility operations.	1. Death 2. Injury	3	1	A	1. There are no hazardous chemical facilities within two miles.
13: What if lightning strikes the facility?	If lightning strikes a sensitive component (i.e. condenser) it could lose power or cause a release.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations.
14: What if a severe rainstorm passes over the facility?	A severe rainstorm can prevent or prohibit a technician from working on a piece of equipment.	1. Delayed emergency response	1	3	A	1. Most ammonia equipment is located indoors. 2. Severe rainstorms are not common in this region.
15: What if a train derails near the facility?	On July 17, 2018, a train derailed near an ammonia refrigeration facility in California. The derailment resulted in a reportable	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. Petaluma Creamery is not located near a railroad.

	diesel spill, but did not damage the refrigeration system. Had the derailment occurred closer to the system, damage to the ammonia equipment could have resulted from fire or physical impact.					

22: Emergency Situation

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if adequate communication is not available for use during an emergency situation? (ANSI/IIAR 6-2019 Safety Systems Checklist Item ee))	During a release responders can't coordinate their actions because radios are clogged with panic talk.	1. Delayed emergency response	3	2	C	1. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations. 2. Petaluma Creamery utilizes cell phones to coordinate during an emergency situation.
2: What if an ammonia release sends a cloud of ammonia off-site?	In the confusion there is a failure to notify off-site receptors such as schools, hospitals, etc. to "Shelter-In-Place" until the cloud passes.	1. Delayed emergency response	3	2	C	1. Off-Site notification list with contacts and phone numbers is included in the emergency response/action program. 2. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations.
3: What if evacuation routes and staging areas have not been selected with consideration of possible incident location, prevailing winds, etc.? (ANSI/IIAR 6-2019 Safety Systems Checklist Item ee))	In September 2012, a facility had a catastrophic ammonia leak that lead to one employee death. The employee that died was in a nearby restroom when the leak began. As he exited the restroom, he attempted to evacuate the area by moving towards the ammonia system instead of away from the system. This was one of the contributing causes to the severity of the accident.	1. Death 2. Injury	4	2	N	1. Employees have been trained for emergency evacuation. This training includes consideration of wind direction, location of ammonia systems, and all other employee responsibilities in an emergency. 2. Petaluma Creamery has two (2) windsocks installed at the corners of the facility to aid in the event of an evacuation.

Recommendation(s):

Evacuation maps are not posted throughout the facility to provide instructions to employees and visitors during an emergency. Ensure that evacuation maps are posted throughout the facility.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

	No related events. **Resolution** **Linked Records**					
4: What if operators are not trained to respond to emergency situations?	During a release, an operator fails to take proper action which could bring the release under control.	1. Delayed emergency response	2	2	A	1. Employees have been trained for emergency evacuation. This training includes consideration of wind direction, location of ammonia systems, and all other employee responsibilities in an emergency.
5: What if SOPs for emergency response have not been implemented? (ANSI/IIAR 7-2019 §4.1)	During an emergency a responder does not have the procedure for a critical emergency procedure.	1. Delayed emergency response	3	2	C	1. Procedures for emergency operations have been developed and implemented as required by CalARP.

23: Facility Siting

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if a thief or vandal gains access and opens a valve releasing ammonia? (ANSI/IIAR 2-2014 Addendum A §6.3.4)	Illegal drug manufacturers attempting to steal ammonia open a valve and release ammonia.	1. Death 2. High pressure liquid ammonia release 3. Injury	4	1	C	1. Most of the facility's ammonia refrigeration equipment is on the roof or in secured buildings. Other equipment is out sight from public view.
	In January 2013, thieves attempting to steal copper broke into an ammonia refrigeration ice rink. During the process of breaking in, an ammonia pipe was broken causing an ammonia leak. The local hazmat team responded, but no one was injured.	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. Most of the facility's ammonia refrigeration equipment is on the roof or in secured buildings. Other equipment is out sight from public view.
2: What if there is no safe access to a critical piece of ammonia equipment? (ANSI/IIAR 2-2014 Addendum A §5.12.1)	In May 2017, a tragic death occurred when a contract employee fell through a skylight at a facility. (https://goo.gl/Zg2wJD)	1. Injury	3	2	C	1. Safe access for normal service and maintenance is provided for the ammonia refrigeration equipment and piping.
3: What if the ammonia refrigeration equipment is located in or adjacent to large populations that could be impacted if there is a chemical release? (ANSI/IIAR 2-2014 Addendum A §4.2)	An ammonia leak in or adjacent to a highly populated room could lead to panic, injury, or death.	1. Death 2. Injury	4	1	C	1. Ammonia is used in process and equipment rooms that are classified and not normally occupied. Large populations may work adjacent to the rooms, but have been trained in the facility emergency procedures. 2. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may

						result in a large-scale ammonia release or other emergency situations.
4: What if adequate emergency shower and eyewash stations are not present? (ANSI/IIAR 2-2014 Addendum A §6.7)	In 2001, a refrigeration technician working on an ammonia valve was splashed in the face with anhydrous ammonia. He was able to quickly get to an eyewash/shower station and still received significant burns. Had no eyewash or shower been available he could have been permanently blinded.	1. Death 2. Injury	4	2	N	1. Emergency eyewash and shower stations are in various locations throughout the facility including inside the machinery room and directly outside the machinery room in the maintenance shop.
	Recommendation(s): During the PHA, a functional test of the eyewash and safety shower initially had no flow of water as the isolation valve supplying water to the eyewash and shower station was closed. Ensure the water supply isolation valve is locked in the open position so the isolation valve is not accidently closed in the future. **Priority** **Responsible Person** **Due Date** **Completed Date** 2 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
5: What if there are not at least two separate means of escape for operating personnel from all locations on the plant? (ANSI/IIAR 2-2014 Addendum A §6.10.1)	In September 2012, a facility had a catastrophic ammonia leak that led to one employee death. One of the contributing causes of the death was that an employee was in a restroom that had a single exit located near the location of the ammonia leak.	1. Death 2. Injury	4	1	C	1. Most rooms (non-restrooms) have multiple doors available to escape during a leak. 2. Petaluma Creamery has developed and implemented an emergency response/action program for scenarios that may result in a large-scale ammonia release or other emergency situations.
6: What if the lighting available is inadequate? (ANSI/IIAR 2-2014 Addendum A §6.11)	During maintenance activities, the lighting in the machinery room shuts off due to timing issues with the movement sensors and the operators can't see what they are doing.	1. Equipment damage 2. Injury	2	2	A	1. The lighting in the machinery room is adequate and equipped with manual control switches.
7: What if the machinery room doors are not equipped with panic hardware and/or do not swing in the direction of egress? (ANSI/IIAR 2-2014 Addendum A §6.10.2)	An employee is exposed to ammonia vapor inside the machinery room and is temporarily unable to see. While attempting to escape the machinery room, he loses valuable seconds while searching for and turning the door handle.	1. Death 2. Injury	4	1	C	1. Both doors to/from the machinery room open outwards and are equipped with panic hardware.

24: Global System Factors

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards

1: What if an accident occurs while charging the system? (ANSI/IIAR 5-2013 §7.3)	A vendor is not monitored and has a hose coupling accident.	1. Death 2. High pressure liquid ammonia release 3. Injury	4	1	C	1. Vendors are closely monitored and check in with an operator when performing work on site. 2. Ammonia supplier trucks are equipped with excess flow valves. These would serve to stop a leak if a hose coupling accident were to occur.
2: What if trace ammonia vapors in the machinery room corrode copper wiring/electrical equipment? (ANSI/IIAR 2-2014 Addendum A §5.7.2.2)	Exposed wires become corroded causing a short-circuit.	1. Equipment damage 2. Reactive maintenance	3	3	N	1. Incidental ammonia leaks are addressed as soon as they are discovered.
	Recommendation(s): Exposed electrical wiring and extension cords were observed in the cold storage room. It is recommended to cover all exposed electrical wiring and provided permanent wiring to the air-cooling evaporators. **Priority** **Responsible Person** **Due Date** **Completed Date** 3 Fernando Ortiz 09/01/2020 **Related Events** No related events. **Resolution** **Linked Records**					
3: What if an unsupervised vendor causes an accident?	An electrician, construction, chemical supply or other vendor providing services damages the ammonia system.	1. Death 2. High pressure liquid ammonia release 3. Injury	4	1	C	1. Vendors are closely monitored and check in with an operator when performing work on site.
4: What if fire hazards, such as improperly stored flammables, are nearby refrigeration equipment? (ANSI/IIAR 2-2014 Addendum A §6.4)	On March 10, 2016 a BLEVE occurred in Westlake, OH when a fire started in close proximity to a propane tank. One of the contributing causes of the accident was that flammable/combustible materials were being stored near the propane tank. [https://goo.gl/uHJWoQ]	1. Death 2. Equipment damage 3. High pressure liquid ammonia release 4. Injury	4	1	C	1. The machinery room is not used for the storage of flammable materials. 2. The machinery room is equipped with a ventilation system to help reduce the ammonia concentration if a leak were to occur inside the machinery room.
5: What if there is a general power failure? (ANSI/IIAR 2-2014 Addendum A §17.2)	On August 23, 2010, 32,000 lbs of ammonia was released during a leak from a refrigeration system. One of the contributing causes of the release was a power failure that occurred at the site. [https://goo.gl/H0Rkd2]	1. Death 2. High pressure vapor ammonia release 3. Injury	2	2	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. The power is not likely to be out long enough for suction pressures to rise significantly.

25: Human Factors

What If	Scenarios	Consequences	Severity	Likelihood	Risk Rankings	Safeguards
1: What if a drain or purge valve is left open? (ANSI/IIAR 2-2014 Addendum A §13.3.6)	In September 2012, a facility had a catastrophic ammonia leak that led to one employee death. The	1. Death 2. High pressure liquid ammonia release 3. Injury	3	2	C	1. Petaluma Creamery performs mechanical integrity inspections on the ammonia refrigeration

	leak started when an employee mistakenly opened an oil drain valve that was not capped or plugged. The missing cap/plug was a contributing factor in the death.						system to identify locations of the system where plugs/caps are missing and makes the repairs when appropriate.
2: What if oil is improperly drained from the system? (ANSI/IIAR 2-2014 Addendum A §5.9.3)	A careless operator is distracted while draining oil and leaves the oil draining station during the operation.	1. Death 2. High pressure liquid ammonia release 3. Injury	4	1	C	1. Spring return valves are used when draining oil, which require continuous attention. 2. Petaluma Creamery uses Alliance Industrial Refrigeration as their refrigeration contractor to oversee this type of work. Alliance Industrial Refrigeration is a licensed refrigeration contractor (License # 825297) 3. Petaluma Creamery has an operating procedure for safely draining oil from an oil drain valve.
3: What if fatigue/overtime work/too many mental tasks/sickness affect an operator?	Too many hours of work will reduce the efficiency of an operator, his ability to recognize problems, and his ability to respond effectively to problems.	1. Injury	2	2	A	1. Alliance Industrial Refrigeration is on call 24/7 to assist with maintenance and/or repairs that onsite operators are unequipped to handle. 2. Staff depth is sufficient to spread out the workload and responsibilities. 3. When operation requires extra hours, multiple shifts are introduced.
4: What if supervisors/employees are not trained to recognize stress/substance abuse problems?	Failure to recognize problems may mean that a dangerous operator is left in charge of the system.	1. Injury	3	1	A	1. Petaluma Creamery encourages safe working practices.
5: What if there is no system readout to indicate a problem? (ANSI/IIAR 2-2014 Addendum A §16.1.2)	An operator might not know of a discharge check valve leaking by on a compressor if there is no pressure gauge on the compressor.	1. Equipment damage	2	2	A	1. Petaluma Creamery refrigeration personnel perform a daily refrigeration system inspection. Any deficiencies are corrected.
6: What if there is not sufficient staff depth for critical positions?	Staff may not be available at a critical time (for example, the only operator that knows what defensive or offensive actions to take is not present when a release occurs).	1. Injury	3	1	A	1. Alliance Industrial Refrigeration is on call 24/7 to assist with maintenance and/or repairs that onsite operators are unequipped to handle. 2. Staff depth is sufficient to spread out the workload and responsibilities.
7: What if an employee must perform maintenance on equipment while it is operating? (Title 8 CCR §3314)	The need to "save product" or "keep engines running" often places pressure on operators to	1. Injury	3	1	A	1. Redundancy in system allows individual shutdown of components.

	work on equipment while it is operating. This dramatically increases the risk of an accident.					2. Petaluma Creamery encourages safe working practices.
8: What if employees fail to report problems? (ANSI/IIAR 6-2019 Appendix D §VI)	A careless operator does not think it is necessary to tell his supervisor about a problem with the system. If problems are not reported they cannot be fixed and could escalate into more severe problems.	1. Equipment damage	3	2	C	1. Petaluma Creamery encourages safe working practices.
9: What if there are no procedures available for operation and maintenance of the refrigeration system? (ANSI/IIAR 7-2019 §4.1)	Operating procedures are "generic" and don't reflect specific steps that must be taken in an emergency situation.	1. Delayed emergency response	2	3	C	1. Standard operating procedures (SOPs) for the refrigeration system have been developed and are reviewed annually.
10: What if process information is not clear, concise, and/or accessible?	Information about the system (specifications, manuals, etc.) which are necessary to safely work on the system have been lost which leads to an operator mistake.	1. Injury	3	2	C	1. All necessary process safety information has been gathered and is readily available.
11: What if there is no mechanism for employees to express human factor-related concerns?	A disgruntled employee may become lazy or ineffective if he/she feels that she is not being listened to.	1. Equipment damage	3	1	A	1. All employees are encouraged to share their opinions on how to make the business better or safer.
12: What if an employee's responsibility is not well defined?	An employee may not realize that he/she is expected to perform a critical task. During an emergency he/she will be unprepared to complete the task.	1. Delayed emergency response	3	2	C	1. All employees are made aware of their responsibilities.
13: What if an electrical transformer is damaged? (2018 IFC §312)	In December 2012 at a facility in Central California, a forklift driver inadvertently impacted an electrical transformer. The impact was significant enough to pull the anchor bolts out of the concrete and expose some electrical wiring. The employee did not report the incident to management. Had the impact been worse, it could have resulted in a prolonged shutdown of the ammonia refrigeration system and potential ammonia release due to increased suction pressure.	1. Equipment damage 2. High pressure vapor ammonia release	3	1	A	1. The ammonia diffusion tank mitigates most of the hazards associated with a relief valve lifting. 2. Petaluma Creamery personnel (including forklift drivers) have been trained to take extra care when working around the refrigeration equipment and other utilities equipment (e.g. electrical transformers). 3. The electrical transformers are protected by three walls and a concrete curb with a chain link gate.

Severity	Description
1	Not detectable by employees/Not reportable/No downtime/<$5K Costs
2	Odor to employee(s)/<Reportable qty/<1 Day downtime/$5-25K Costs
3	Reportable injury(ies)/>Reportable qty/1-5 Days downtime/$25-100K Costs
4	Serious injury(ies) or fatality/Offsite injury(ies)/>5 Days downtime/>$100K Costs

Likelihood	Description
1	Not expected to occur in the lifetime of the facility/Less than once in 20 years
2	Could occur once in the lifetime of the facility/Once in 20 years
3	Could occur several times in the lifetime of the facility/Once every five years
4	Occurs frequently/One or more times a year

Risk Ranking	Description
A	Acceptable - No risk control measures are needed
C	Acceptable With Control - Risk control measures are in place
N	Not Desirable - Risk control measures to be introduced within a specified time period
U	Unacceptable - Risk control measures to be completed at earliest possible opportunity

Subsystem Totals

Subsystems 25 What-If Questions 200 Scenarios 220 Safeguards 134 Recommendations 23

Severity Level	Severity Sum	%
1	9	4%
2	57	25%
3	85	38%
4	69	31%

Likelihood Level	Likelihood Sum	%
1	112	50%
2	81	36%
3	25	11%
4	2	0%

Risk Ranking	Risk Sum	%
A	99	45%
C	107	48%
N	14	6%

Recommendations

Subsystem	What If
High Pressure Receiver	4: What if a crack develops in the shell of the high pressure receiver? (ANSI/IIAR 2-2014 Addendum A Appendix H)

Recommendation #1

The refrigeration system's auto-purger is not functioning. It is recommended that the auto-purger be fixed or replaced so non-condensibles can be automatically purged from the ammonia refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
High Pressure Receiver	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Surge Drums	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Transfer Pump	5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Ceiling Suspended Evaporators	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Plate & Frame Heat Exchanger	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Ice Builders	2: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Main Suction Accumulator	5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Evaporative Condenser	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Piping	6: What if pipes are not properly labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.6, §6.6.3)
Ammonia Diffusion Tank	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Auto-Purger	4: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)

Recommendation #2

Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	2: What if the back pressure regulator on the suction return line fails? (ANSI/IIAR 7-2019 §10.3(1))
Surge Drums	2: What if the back pressure regulator on the suction return line fails? (ANSI/IIAR 7-2019 §10.3(1))
Surge Drums	7: What if the operating level float switch fails? (ANSI/IIAR 2-2014 Addendum A §5.12.3)

Recommendation #3

It is recommended to equip each Ice Builder with temperature probes which provide continuous temperature monitoring and alarm capabilities if the temperature in the Ice Builder deviates outside of a predetermined range.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2022	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	4: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)

Recommendation #4

The Ice Builder #2 Surge Drum is not insulated. It is recommended that the facility insulate the vessel to prevent excessive ice build up and external corrosion.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	5: What if uncertified alterations/modifications are made to the vessel? (ANSI/IIAR 6-2019 §5.3.3(7))
Surge Drums	10: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)

Recommendation #5

Ice builder 1 Surge drums 1 and 2 nameplates are not accessible because the nameplates are located under insulation. Expose the nameplates and obtain the associated manufacturer data reports.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Plate & Frame Heat Exchanger	1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)

Recommendation #6

It was observed that there is forklift and hand truck traffic near the Glycol Heat Exchanger. It is recommended that the facility install barrier posts around the equipment to protect the Glycol Heat Exchanger from accidental impact from forklift traffic.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Ice Builders	5: What if ice builder pipes are subject to corrosion?

Recommendation #7

There is extensive corrosion associated with Ice Builder #1. It was discussed that the Ice Builder has been valved off from the refrigeration system and is not in operation, but it is recommended to completely cut and cap the Ice Builder from the refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	2: What if the high level cutout float switch fails? (ANSI/IIAR 2-2014 Addendum A §8.4.9)

Recommendation #8

The high level float switch on the Suction Accumulator was last tested 7/17/2018. Ensure the Suction Accumulator high level float switch is tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	3: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)

Recommendation #9

The Suction Accumulator and associated insulated piping is not adequately insulated. It is recommended to reinsulate the Suction Accumulator and associated piping with the appropriate vapor barrier, insulation, and jacketing that is rated for industrial refrigeration.

Priority	Responsible Person	Due Date	Completed Date
1	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	7: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)

Recommendation #10

The Suction Accumulator nameplate is illegible due to corrosion on the nameplate. It is recommended that a concerted effort be made to clean the nameplate and obtain the associated manufacturer data report.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Screw Compressors	2: What if the compressor safety devices are not tested on a regular basis? (ANSI/IIAR 6-2019 Table 6.1 Testing Items 'A'-'D')

Recommendation #11

The compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts safety devices were last tested in 2018. Ensure that the compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts are tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Screw Compressors	3: What if the lubrication for the compressor fails? (ANSI/IIAR 7-2019 §6.3(1))

Recommendation #12

The PHA team could not confirm when oil analysis was last performed on the compressors. Ensure that a maintenance schedule is developed and implemented for the compressor oil.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Evaporative Condenser	5: What if there is insufficient condenser cooling water? (ANSI/IIAR 7-2019 §8.3(1))
Valves	3: What if debris prevents a valve from sealing? (ANSI/IIAR 2-2014 Addendum A §13.3.6)
Relief Valves	1: What if the preventative maintenance program for relief valves is insufficient or non-existent? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q)

Recommendation #13

The facility has just changed their refrigeration contractor to Alliance Industrial Refrigeration, and it is unclear how the inspection, test, and maintenance activities related to the ammonia refrigeration system are being addressed. It is recommended to develop a mechanical integrity program for the ammonia refrigeration system and distinguish responsibility of activities between the facility and contractor.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Evaporative Condenser	9: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)

Recommendation #14

There is no permanent access to the top of the condenser for facility personnel and contractors to safely perform maintenance activities. It is recommended that a permanent ladder be installed to provide safe access at the top of the condenser.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Piping	2: What if refrigerant pipes are subject to corrosion? (ANSI/IIAR 6-2019 Table 11.1 Inspection Item 'A')
Piping	2: What if refrigerant pipes are subject to corrosion? (ANSI/IIAR 6-2019 Table 11.1 Inspection Item 'A')
Piping	6: What if pipes are not properly labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.6, §6.6.3)

Recommendation #15

Although much of the ammonia equipment, piping, and valves located in the machinery room have been cleaned and painted, there is an extensive amount of outdoor and cooler room ammonia equipment, piping, and valves that need to be cleaned and painted to arrest corrosion. Ensure that all outdoor and cooler room equipment, pipe, and valves are cleaned and painted.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Valves	1: What if a valve is over tightened? (ANSI/IIAR 6-2019 §A.5.6.5.1)

Recommendation #16

The facility has just begun to work with a new refrigeration contractor, Alliance Industrial Refrigeration. It is recommended the facility obtain a contractor qualification packet for Alliance Industrial Refrigeration.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Relief Valves	3: What if a relief valve capacity is too low? (ANSI/IIAR 2-2014 Addendum A §15.3.8.1)

Recommendation #17

The Ammonia Refrigeration System Relief System Analysis completed by APCCO on July 22, 2019 reveals several instances the relief system is deficient: Suction Accumulator, Condenser 1, Condenser 2, etc. It is recommended the facility update their relief system to properly upsize the relief vent piping and change the relief valves for proper sizing and capacity when the relief valves are changed out in August 2020.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Ventilation	2: What if an "Emergency Ventilation Switch" is not installed? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Ventilation	3: What if the "Emergency Ventilation Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Ventilation	5: What if the "Emergency Ventilation Switch" is not located where it can easily be activated? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Stop Switch	4: What if the "Emergency Stop Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.1)
Emergency Stop Switch	5: What if the "Emergency Stop Switch" is not accessible? (ANSI/IIAR 2-2014 Addendum A §6.12.1)

Recommendation #18

The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Stop Switch	2: What if the "Emergency Stop Switch" does not work? (ANSI/IIAR 2-2014 Addendum A §6.12.1)

Recommendation #19

The e-stop button was last tested 7/3/2018. Ensure the emergency stop button is tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Ammonia Detection	1: What if the ammonia detection does not work? (ANSI/IIAR 2-2014 Addendum A §17.3)
Ammonia Detection	2: What if ammonia detection is not installed? (ANSI/IIAR 2-2014 Addendum A §17.1)
Ammonia Detection	5: What if the ammonia detection does not automatically activate the emergency exhaust ventilation system? (ANSI/IIAR 2-2014 Addendum A §6.13.2.3)
Ammonia Detection	6: What if the ammonia detection is not set at the correct ppm? (ANSI/IIAR 2-2014 Addendum A §17.7)
Ammonia Detection	3: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §17.6)

Recommendation #20

The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A.

Priority	Responsible Person	Due Date	Completed Date
1	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Situation	3: What if evacuation routes and staging areas have not been selected with consideration of possible incident location, prevailing winds, etc.? (ANSI/IIAR 6-2019 Safety Systems Checklist Item ee))

Recommendation #21

Evacuation maps are not posted throughout the facility to provide instructions to employees and visitors during an emergency. Ensure that evacuation maps are posted throughout the facility.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Facility Siting	4: What if adequate emergency shower and eyewash stations are not present? (ANSI/IIAR 2-2014 Addendum A §6.7)

Recommendation #22

During the PHA, a functional test of the eyewash and safety shower initially had no flow of water as the isolation valve supplying water to the eyewash and shower station was closed. Ensure the water supply isolation valve is locked in the open position so the isolation valve is not accidently closed in the future.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Global System Factors	2: What if trace ammonia vapors in the machinery room corrode copper wiring/electrical equipment? (ANSI/IIAR 2-2014 Addendum A §5.7.2.2)

Recommendation #23

Exposed electrical wiring and extension cords were observed in the cold storage room. It is recommended to cover all exposed electrical wiring and provided permanent wiring to the air-cooling evaporators.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Sessions

Session # 2020-01 **Session Name:** Hazard Review Session #01 **Leader:** Nate Torres
Date: 02/17/2020 **Duration:** 6 hrs **Scribe:** Nate Torres

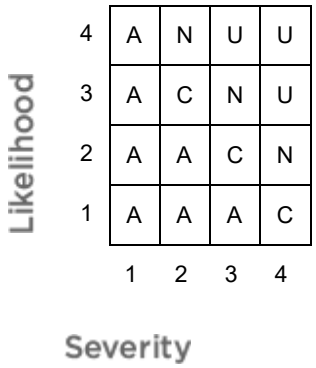
Attendee Name	Attendance	Company Name	Phone	Expertise
Fernando Ortiz	Complete	Petaluma Creamery		Maintenance, Ammonia Refrigeration, Process Operations
Nate Torres	Complete	Resource Compliance, Inc.	(559) 591-8898	Process Safety Management, PHA Leadership

Session # 2020-02 **Session Name:** Hazard Review Session #02 **Leader:** Nate Torres
Date: 02/18/2020 **Duration:** 6 hrs **Scribe:** Nate Torres

Attendee Name	Attendance	Company Name	Phone	Expertise
Fernando Ortiz	Complete	Petaluma Creamery		Ammonia Refrigeration, Maintenance, Process Operatinos
Larry Peter	Partial	Petaluma Creamery		Process Operations
Nate Torres	Complete	Resource Compliance, Inc.	(559) 591-8898	Process Safety Management, PHA Leadership

Risk Matrix

Risk Ranking Profile: Resource Compliance



Severity	Description
1	Not detectable by employees/Not reportable/No downtime/<$5K Costs
2	Odor to employee(s)/<Reportable qty/<1 Day downtime/$5-25K Costs
3	Reportable injury(ies)/>Reportable qty/1-5 Days downtime/$25-100K Costs
4	Serious injury(ies) or fatality/Offsite injury(ies)/>5 Days downtime/>$100K Costs

Likelihood	Description
1	Not expected to occur in the lifetime of the facility/Less than once in 20 years
2	Could occur once in the lifetime of the facility/Once in 20 years
3	Could occur several times in the lifetime of the facility/Once every five years
4	Occurs frequently/One or more times a year

Risk Ranking	Description
A	Acceptable - No risk control measures are needed
C	Acceptable With Control - Risk control measures are in place
N	Not Desirable - Risk control measures to be introduced within a specified time period
U	Unacceptable - Risk control measures to be completed at earliest possible opportunity

Recommendations

Subsystem	What If
High Pressure Receiver	4: What if a crack develops in the shell of the high pressure receiver? (ANSI/IIAR 2-2014 Addendum A Appendix H)

Recommendation #1

The refrigeration system's auto-purger is not functioning. It is recommended that the auto-purger be fixed or replaced so non-condensibles can be automatically purged from the ammonia refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
High Pressure Receiver	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Surge Drums	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Transfer Pump	5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Ceiling Suspended Evaporators	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Plate & Frame Heat Exchanger	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Ice Builders	2: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Main Suction Accumulator	5: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Evaporative Condenser	8: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Piping	6: What if pipes are not properly labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.6, §6.6.3)
Ammonia Diffusion Tank	6: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)
Auto-Purger	4: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.3)

Recommendation #2

Although some of the ammonia equipment and piping located in the machinery room have been labeled with component markers and pipe labels, there is an extensive amount of outdoor and cooler room ammonia equipment and piping that need component markers and pipe labels. Ensure that all outdoor and cooler room equipment and piping is properly labeled.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	2: What if the back pressure regulator on the suction return line fails? (ANSI/IIAR 7-2019 §10.3(1))
Surge Drums	2: What if the back pressure regulator on the suction return line fails? (ANSI/IIAR 7-2019 §10.3(1))
Surge Drums	7: What if the operating level float switch fails? (ANSI/IIAR 2-2014 Addendum A §5.12.3)

Recommendation #3

It is recommended to equip each Ice Builder with temperature probes which provide continuous temperature monitoring and alarm capabilities if the temperature in the Ice Builder deviates outside of a predetermined range.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2022	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	4: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)

Recommendation #4

The Ice Builder #2 Surge Drum is not insulated. It is recommended that the facility insulate the vessel to prevent excessive ice build up and external corrosion.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Surge Drums	5: What if uncertified alterations/modifications are made to the vessel? (ANSI/IIAR 6-2019 §5.3.3(7))
Surge Drums	10: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)

Recommendation #5

Ice builder 1 Surge drums 1 and 2 nameplates are not accessible because the nameplates are located under insulation. Expose the nameplates and obtain the associated manufacturer data reports.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Plate & Frame Heat Exchanger	1: What if the equipment or associated components is damaged by nearby activity? (ANSI/IIAR 2-2014 Addendum A §5.17.1)

Recommendation #6

It was observed that there is forklift and hand truck traffic near the Glycol Heat Exchanger. It is recommended that the facility install barrier posts around the equipment to protect the Glycol Heat Exchanger from accidental impact from forklift traffic.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Ice Builders	5: What if ice builder pipes are subject to corrosion?

Recommendation #7

There is extensive corrosion associated with Ice Builder #1. It was discussed that the Ice Builder has been valved off from the refrigeration system and is not in operation, but it is recommended to completely cut and cap the Ice Builder from the refrigeration system.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	2: What if the high level cutout float switch fails? (ANSI/IIAR 2-2014 Addendum A §8.4.9)

Recommendation #8

The high level float switch on the Suction Accumulator was last tested 7/17/2018. Ensure the Suction Accumulator high level float switch is tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	3: What if the insulation on the vessel is compromised? (ANSI/IIAR 2-2014 Addendum A §5.10.1)

Recommendation #9

The Suction Accumulator and associated insulated piping is not adequately insulated. It is recommended to reinsulate the Suction Accumulator and associated piping with the appropriate vapor barrier, insulation, and jacketing that is rated for industrial refrigeration.

Priority	Responsible Person	Due Date	Completed Date
1	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Main Suction Accumulator	7: What if the equipment lacks a nameplate? (ANSI/IIAR 2-2014 Addendum A §12.4)

Recommendation #10

The Suction Accumulator nameplate is illegible due to corrosion on the nameplate. It is recommended that a concerted effort be made to clean the nameplate and obtain the associated manufacturer data report.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Screw Compressors	2: What if the compressor safety devices are not tested on a regular basis? (ANSI/IIAR 6-2019 Table 6.1 Testing Items 'A'-'D')

Recommendation #11

The compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts safety devices were last tested in 2018. Ensure that the compressor high pressure cutouts, low pressure cutouts, and oil pressure cutouts are tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Screw Compressors	3: What if the lubrication for the compressor fails? (ANSI/IIAR 7-2019 §6.3(1))

Recommendation #12

The PHA team could not confirm when oil analysis was last performed on the compressors. Ensure that a maintenance schedule is developed and implemented for the compressor oil.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Evaporative Condenser	5: What if there is insufficient condenser cooling water? (ANSI/IIAR 7-2019 §8.3(1))
Valves	3: What if debris prevents a valve from sealing? (ANSI/IIAR 2-2014 Addendum A §13.3.6)
Relief Valves	1: What if the preventative maintenance program for relief valves is insufficient or non-existent? (ANSI/IIAR 6-2019 Pressure Relief System Checklist Item q)

Recommendation #13

The facility has just changed their refrigeration contractor to Alliance Industrial Refrigeration, and it is unclear how the inspection, test, and maintenance activities related to the ammonia refrigeration system are being addressed. It is recommended to develop a mechanical integrity program for the ammonia refrigeration system and distinguish responsibility of activities between the facility and contractor.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Evaporative Condenser	9: What if the equipment is not accessible? (ANSI/IIAR 2-2014 Addendum A §5.12.1)

Recommendation #14

There is no permanent access to the top of the condenser for facility personnel and contractors to safely perform maintenance activities. It is recommended that a permanent ladder be installed to provide safe access at the top of the condenser.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Piping	2: What if refrigerant pipes are subject to corrosion? (ANSI/IIAR 6-2019 Table 11.1 Inspection Item 'A')
Piping	2: What if refrigerant pipes are subject to corrosion? (ANSI/IIAR 6-2019 Table 11.1 Inspection Item 'A')
Piping	6: What if pipes are not properly labeled? (ANSI/IIAR 2-2014 Addendum A §5.14.6, §6.6.3)

Recommendation #15

Although much of the ammonia equipment, piping, and valves located in the machinery room have been cleaned and painted, there is an extensive amount of outdoor and cooler room ammonia equipment, piping, and valves that need to be cleaned and painted to arrest corrosion. Ensure that all outdoor and cooler room equipment, pipe, and valves are cleaned and painted.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Valves	1: What if a valve is over tightened? (ANSI/IIAR 6-2019 §A.5.6.5.1)

Recommendation #16

The facility has just begun to work with a new refrigeration contractor, Alliance Industrial Refrigeration. It is recommended the facility obtain a contractor qualification packet for Alliance Industrial Refrigeration.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Relief Valves	3: What if a relief valve capacity is too low? (ANSI/IIAR 2-2014 Addendum A §15.3.8.1)

Recommendation #17

The Ammonia Refrigeration System Relief System Analysis completed by APCCO on July 22, 2019 reveals several instances the relief system is deficient: Suction Accumulator, Condenser 1, Condenser 2, etc. It is recommended the facility update their relief system to properly upsize the relief vent piping and change the relief valves for proper sizing and capacity when the relief valves are changed out in August 2020.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Ventilation	2: What if an "Emergency Ventilation Switch" is not installed? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Ventilation	3: What if the "Emergency Ventilation Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Ventilation	5: What if the "Emergency Ventilation Switch" is not located where it can easily be activated? (ANSI/IIAR 2-2014 Addendum A §6.12.2)
Emergency Stop Switch	4: What if the "Emergency Stop Switch" is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §6.12.1)
Emergency Stop Switch	5: What if the "Emergency Stop Switch" is not accessible? (ANSI/IIAR 2-2014 Addendum A §6.12.1)

Recommendation #18

The E-Stop and Emergency Ventilation switches are in the Maintenance Shop where the buttons can easily be covered by parts and/or tools or be accidently activated. It is recommended that the E-Stop and Emergency Ventilation switches be relocated at the entrance door to the machinery room and labeled accordingly.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	03/01/2021	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Stop Switch	2: What if the "Emergency Stop Switch" does not work? (ANSI/IIAR 2-2014 Addendum A §6.12.1)

Recommendation #19

The e-stop button was last tested 7/3/2018. Ensure the emergency stop button is tested and perform subsequent tests annually.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Ammonia Detection	1: What if the ammonia detection does not work? (ANSI/IIAR 2-2014 Addendum A §17.3)
Ammonia Detection	2: What if ammonia detection is not installed? (ANSI/IIAR 2-2014 Addendum A §17.1)
Ammonia Detection	5: What if the ammonia detection does not automatically activate the emergency exhaust ventilation system? (ANSI/IIAR 2-2014 Addendum A §6.13.2.3)
Ammonia Detection	6: What if the ammonia detection is not set at the correct ppm? (ANSI/IIAR 2-2014 Addendum A §17.7)
Ammonia Detection	3: What if the equipment is not adequately labeled? (ANSI/IIAR 2-2014 Addendum A §17.6)

Recommendation #20

The ammonia detection system function is unknown by the facility personnel. Additionally, the ammonia detection sensors are currently not calibrated or functioning. It is recommended that the facility replace the bad ammonia sensors and update the ammonia detection system to function according to the requirements in ANSI/IIAR 2-2014 Addendum A.

Priority	Responsible Person	Due Date	Completed Date
1	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Emergency Situation	3: What if evacuation routes and staging areas have not been selected with consideration of possible incident location, prevailing winds, etc.? (ANSI/IIAR 6-2019 Safety Systems Checklist Item ee))

Recommendation #21

Evacuation maps are not posted throughout the facility to provide instructions to employees and visitors during an emergency. Ensure that evacuation maps are posted throughout the facility.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Facility Siting	4: What if adequate emergency shower and eyewash stations are not present? (ANSI/IIAR 2-2014 Addendum A §6.7)

Recommendation #22

During the PHA, a functional test of the eyewash and safety shower initially had no flow of water as the isolation valve supplying water to the eyewash and shower station was closed. Ensure the water supply isolation valve is locked in the open position so the isolation valve is not accidently closed in the future.

Priority	Responsible Person	Due Date	Completed Date
2	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records

Subsystem	What If
Global System Factors	2: What if trace ammonia vapors in the machinery room corrode copper wiring/electrical equipment? (ANSI/IIAR 2-2014 Addendum A §5.7.2.2)

Recommendation #23

Exposed electrical wiring and extension cords were observed in the cold storage room. It is recommended to cover all exposed electrical wiring and provided permanent wiring to the air-cooling evaporators.

Priority	Responsible Person	Due Date	Completed Date
3	Fernando Ortiz	09/01/2020	

Related Events

No related events.

Resolution

Linked Records