Applications of P&ID Drawings within Select Prevention Program Elements

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Agenda

- Ammonia Refrigeration Process
- Anatomy of a Piping and Instrumentation Diagram (P&ID)
- **Process Safety Information**
- **Process Hazard Analysis**
- **Management of Change / Process Modification**
- **Emergency Response** incident

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Industrial Refrigeration Process

- Remove **HEAT** from a place we don't want it, to a place where it does not harm.
- Refrigerating Engineers and Technicians Association: reta.com

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March 20-23, 2023

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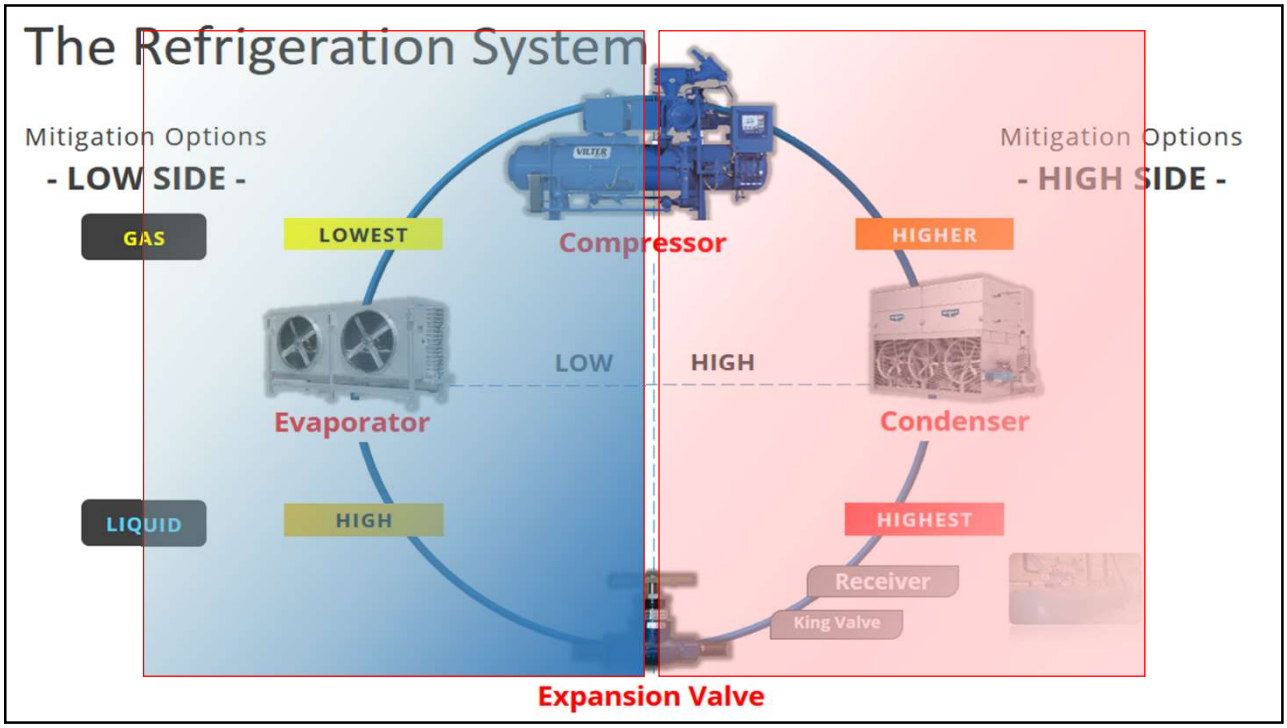

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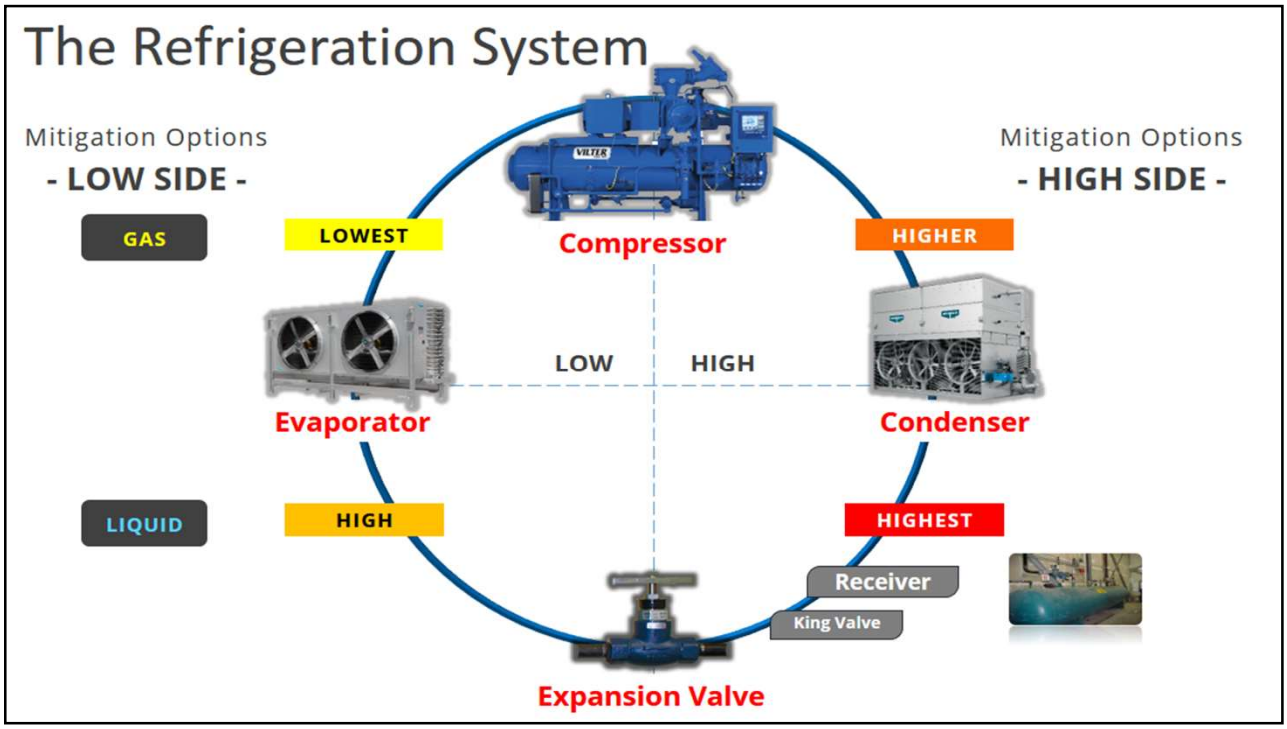

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Piping & Instrumentation Diagram (P&ID)

Mr. Robert Lucas, a wise US EPA Region 9 EPCRA/RMP Inspector once said to me:

"A true P&ID is a one stop shop for all PSI data"

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Process Safety Information

For chemicals, you must complete information on:	For process technology, you must provide:	For equipment in the process, you must include information on:
✔Toxicity ✔Permissible exposure limits ✔Physical data ✔Reactivity ✔Corrosivity ✔Thermal & chemical stability ✔Hazardous effects of inadvertent mixing of materials that could foreseeably occur	✔A block flow diagram or simplified process flow diagram ✔Information on process chemistry ✔Maximum intended inventory of the EPA-regulated chemical ✔Safe upper & lower limits for such items as temperature, pressure, flows, or composition ✔An evaluation of the consequences of deviation	✔Materials of construction ✔Piping & instrument diagrams (P&IDs) ✔Electrical classification ✔Relief system design & design basis ✔Ventilation system design ✔Design codes & standards employed ✔Safety systems ✔Material and energy balances for processes built after June 21, 1999

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Piping & Instrumentation Diagram (P&ID)

Program 3 P&ID:

- An engineering drawing that shows the process flow for an industrial plant or facility.
- It typically includes details such as process equipment, instrumentation, and control systems.

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Piping & Instrumentation Diagram (P&ID)

- Title Sheet schedule listing:
  - All diagrams in the drawing set.
  - Legend with piping/mechanical symbols & abbreviations
  - General notes –
    - piping specifications
    - ANSI/ASME B31.5 or IIAR-2 references
    - pipe labeling, valve tagging, safety valve and other information relating to the refrigeration system

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Piping & Instrumentation Diagram (P&ID)

Program 3 P&ID:

- pressure and temperature switches, pressure relief valves, and **emergency shutdown valves***

***Emergency Response**

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Piping & Instrumentation Diagram (P&ID)

- Ammonia refrigerant pipes, valves and fittings.
- Vessel and heat exchanger liquid refrigerant operating levels. Minimum and maximum may be included in other documentation at the facility such as the process safety information or operating procedures.

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Piping & Instrumentation Diagram (P&ID)

- Energy balance information including mass flows, design operating conditions, pressures and temperatures, which may be required depending upon system size and location.
- Ammonia process equipment including pressure vessels, condensers, compressors, evaporators, air purgers, liquid transfer equipment, desuperheaters, heat exchangers, etc.

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Piping & Instrumentation Diagram (P&ID)

- Permanent instrumentation and sensors, pressure transducers, transmitters, thermometers, pressure gauges, drainer valves, float switches that are physically connected to the ammonia refrigerant lines.
- Line sizes, designation and commodity.
- Reference to interface with secondary heat transfer fluids, water cooling piping, condenser water piping and brine piping.

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Valve Schedules

A	B	C	D	E	F	G	H	I
TAG#	SIZE	LINE	STAT	ABBR	DESCRIPTION	DWG	LOCATION	COMMENTS/NOTES
HS01					FRICK HIGH STAGE SCREW COMPRESSOR PKG MODEL: #RWF-II-270	R-02/10	COMPRESSOR ROOM	S/N: XXXXX (2018)
FF# L97004					+25°F SST / +85°F SDT - 632.4 TONS @ 570.1 BHP			
					MOTOR: 625 HP (SS)			
OS01					FRICK OIL SEPARATOR: 36"Ø X XX'-0" OAL	R-02/10	HS01	N/B: XXXXX
FF# L97016					DESIGN PRESSURE / TEMPERATURE: XXX PSI @ +XXX°F/-XX°F			S/N: XXXXX (2018)
HS01-01	8"	HTS	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	
HS01-02	8"	HTS	N.C.	CV	CHECK VALVE	R-02/10	HS01	
HS01-03	6"	HSD	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	
HS01-04	6"	HSD	N.C.	CV	STOP/CHECK VALVE	R-02/10	HS01	
HS01-05	1/4"	HSD	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	SERVICE VALVE
HS01-06	3/4"	RV	-----	WV	THREE-WAY VALVE	R-02/10	HS01	
HS01-07	3/4"	RV	-----	RV	RELIEF VALVE	R-02/10	HS01	SHANK #814 @ 300 PSI
HS01-08	3/4"	RV	-----	RV	RELIEF VALVE	R-02/10	HS01	SHANK #814 @ 300 PSI
HS01-09	3/4"	LIC	N.O.	GV	GLOBE SHUT-OFF VALVE	R-02/10	HS01	DANFOSS #ICF-20B
HS01-10	3/4"	LIC	------	MV	MOTORIZED VALVE	R-02/10	HS01	DANFOSS #ICF-20B
HS01-11	3/4"	LIC	N.C.	SV	SOLENOID VALVE	R-02/10	HS01	DANFOSS #ICF-20B
HS01-12								
HS01-13	3/4"	LIC	-----	ST	STRAINER	R-02/10	HS01	DANFOSS #ICF-20B
HS01-14	3/8"	LIC	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	SERVICE VALVE
HS01-15	3/4"	LIC	N.O.	GV	GLOBE SHUT-OFF VALVE	R-02/10	HS01	DANFOSS #ICF-20B
HS01-16	3/4"	-----	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	PUMPOUT
HS01-17	1/2"	OD	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	SERVICE VALVE
HS01-18	2-1/2"	OD	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	
HS01-19	1/4"	OD	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	TRANSDUCER VALVE
HS01-20	1/2"	OD	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	SERVICE VALVE
HS01-21	1/4"	OD	N.C.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	SERVICE VALVE
HS01-22	2-1/2"	OD	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	
HS01-23	1/4"	OD	N.O.	AV	ANGLE SHUT-OFF VALVE	R-02/10	HS01	

Compressors | Condensers | Recirculators | Vessels | Evaporators | Heat Exchangers | Chillers | Air Handling Units | Misc Equip

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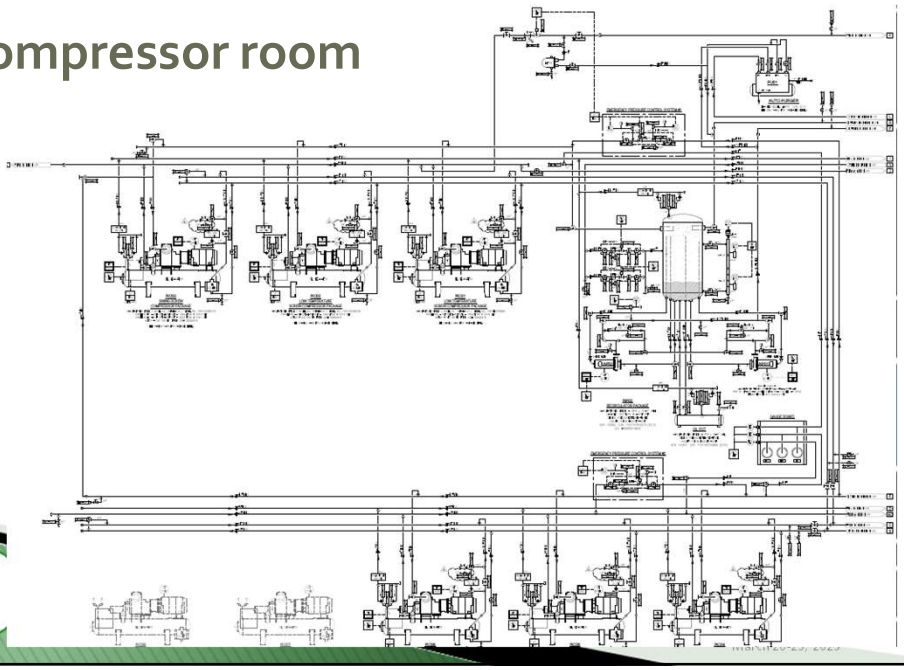
P&ID – compressor room



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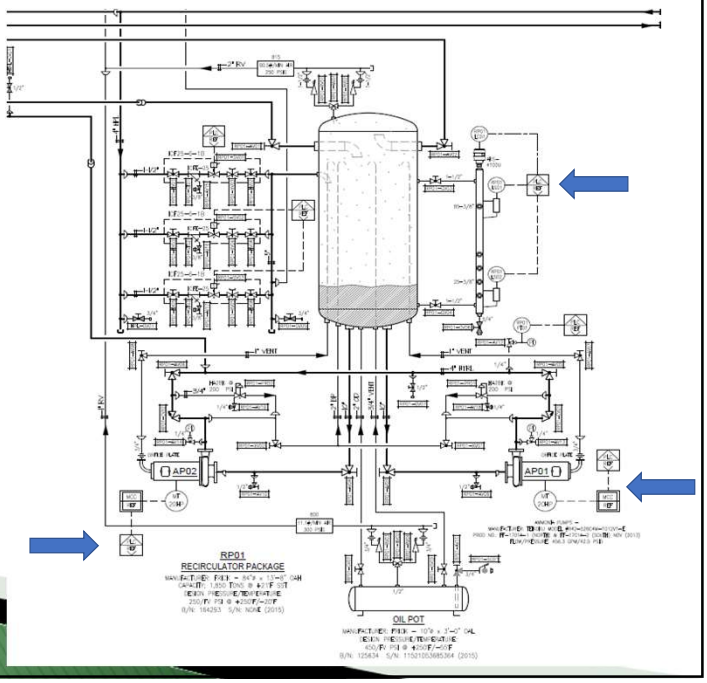
P&ID – Low Pressure Receiver



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Hazard Review

The owner or operator shall conduct a **review of the hazards** associated with the **regulated substances, processes,** and **procedures.**

The review shall identify the following:

- The hazards associated with the process and regulated substances;
- Opportunities for **equipment malfunctions** or **human errors** that could cause an accidental release;
- The **safeguards** used or needed to **control the hazards** or prevent equipment malfunction or human error; and,
- Any steps used or needed to **detect or monitor releases**.

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Hazard Review

- The owner or operator of a stationary source **shall consult with the UPA** to decide which hazard review methodology is best suited to determine and evaluate the hazards of the process being analyzed.
- The owner or operator **may use checklists**, <u>if acceptable to the UPA</u>, **developed by persons or organizations knowledgeable about the process and equipment** as a guide to conducting the review. The hazard review shall be performed by a team familiar with process operations and shall include at least one employee who has experience and knowledge specific to the process being reviewed. For processes designed to <u>meet industry standards</u> or federal or state design rules, the hazard review shall, <u>by inspecting all equipment</u>, <u>determine whether the process is designed, fabricated, and operated in accordance with the applicable standards or rules.</u>

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Process Safety Information

- the owner or operator shall complete a compilation of written process safety information before conducting any PHA required by the chapter.

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Process Safety Information

For chemicals, you must complete information on:	For process technology, you must provide:	For equipment in the process, you must include information on:
✔Toxicity ✔Permissible exposure limits ✔Physical data ✔Reactivity ✔Corrosivity ✔Thermal & chemical stability ✔Hazardous effects of inadvertent mixing of materials that could foreseeably occur	✔A block flow diagram or simplified process flow diagram ✔Information on process chemistry ✔Maximum intended inventory of the EPA-regulated chemical ✔Safe upper & lower limits for such items as temperature, pressure, flows, or composition ✔An evaluation of the consequences of deviation	✔Materials of construction ✔Piping & instrument diagrams (P&IDs) ✔Electrical classification ✔Relief system design & design basis ✔Ventilation system design ✔Design codes & standards employed ✔Safety systems ✔Material and energy balances for processes built after June 21, 1999

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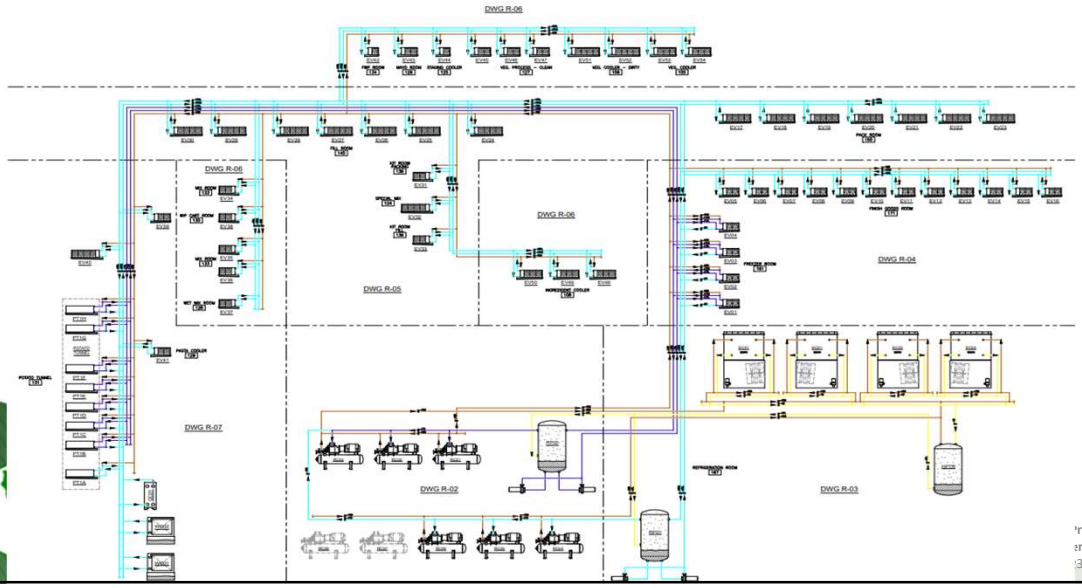
PSI - Block Flow Diagram



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Process Hazard Analysis

The PHA shall be appropriate to the complexity of the process and shall **identify, evaluate, and control the hazards involved in the process**.

The owner or operator **shall work closely** with UPAs in deciding which PHA methodology is best suited to determine the hazards of the process being analyzed. Ow/Op shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed:

(1) What-If*
(2) Checklist*
(3) What-If / Checklist*
(4) Hazard and Operability Study (HAZOP);
(5) Failure Mode and Effects Analysis (FMEA);
(6) Fault Tree Analysis; or,
(7) An appropriate equivalent methodology.

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*** IIAR recommended methods**

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Process Modification

(a) When an owner or operator **intends to make a modification to a stationary source relating to a covered process** and the modification may result in a significant increase in either: the amount of regulated substances handled at the stationary source as compared to the amount of regulated substances identified in the stationary source's RMP, or the risk of handling a regulated substance as compared to the amount of risk identified** in the stationary source's RMP, then the owner or operator shall do all of the following:

*** Preliminary Determination aka Risk Ranking*

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Process Modification

(1) Where reasonably possible, notify the UPA in writing of the owner or operator's intent to modify the stationary source at least five calendar days before implementing any modifications. As part of the notification process, the owner or operator shall consult with the UPA when determining whether the RMP should be reviewed and revised. Where prenotification is not reasonably possible, the owner or operator shall provide written notice to the UPA no later than 48 hours following the modification.

(2) Establish procedures to manage the proposed modification, which shall be substantially similar to the procedures specified in Sections 2760.6 and 2760.7, and notify the UPA that the procedures have been established.
(b) The owner or operator of the stationary source **shall revise the appropriate documents**, as required pursuant to section (a), expeditiously, but not later than 60 days from the date of the stationary source modification.

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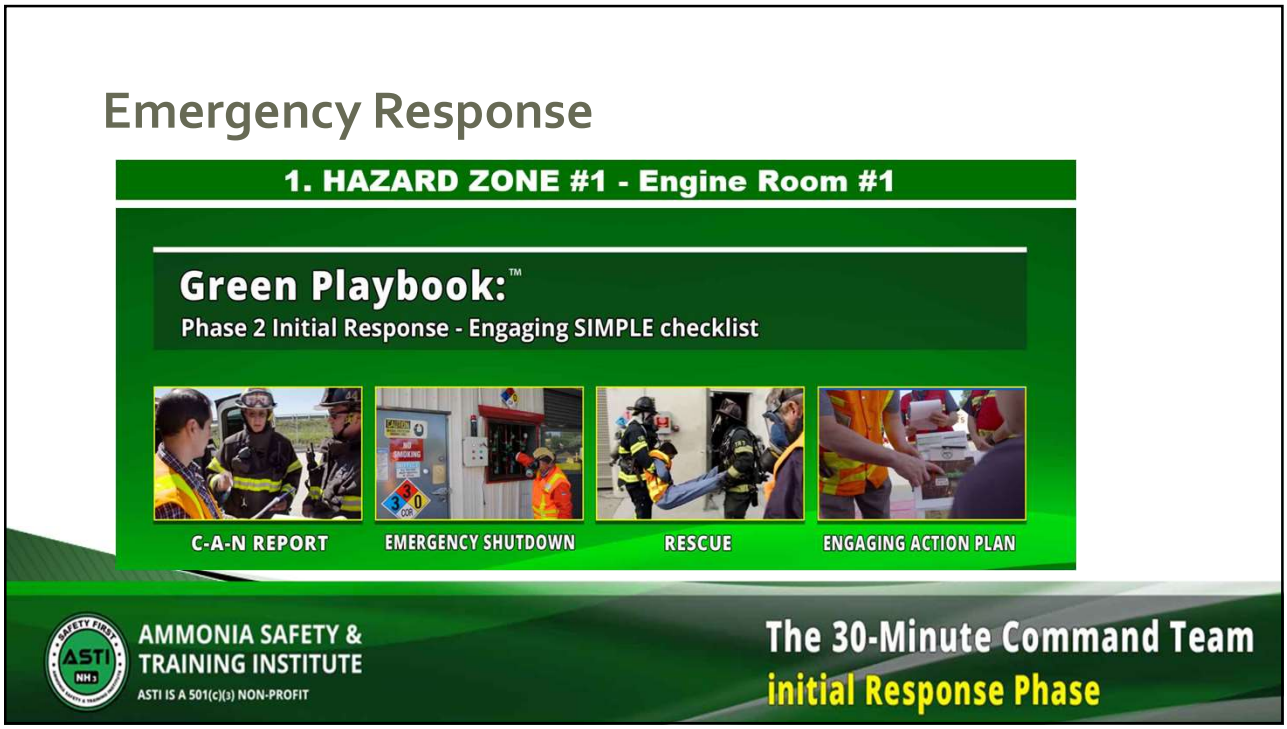

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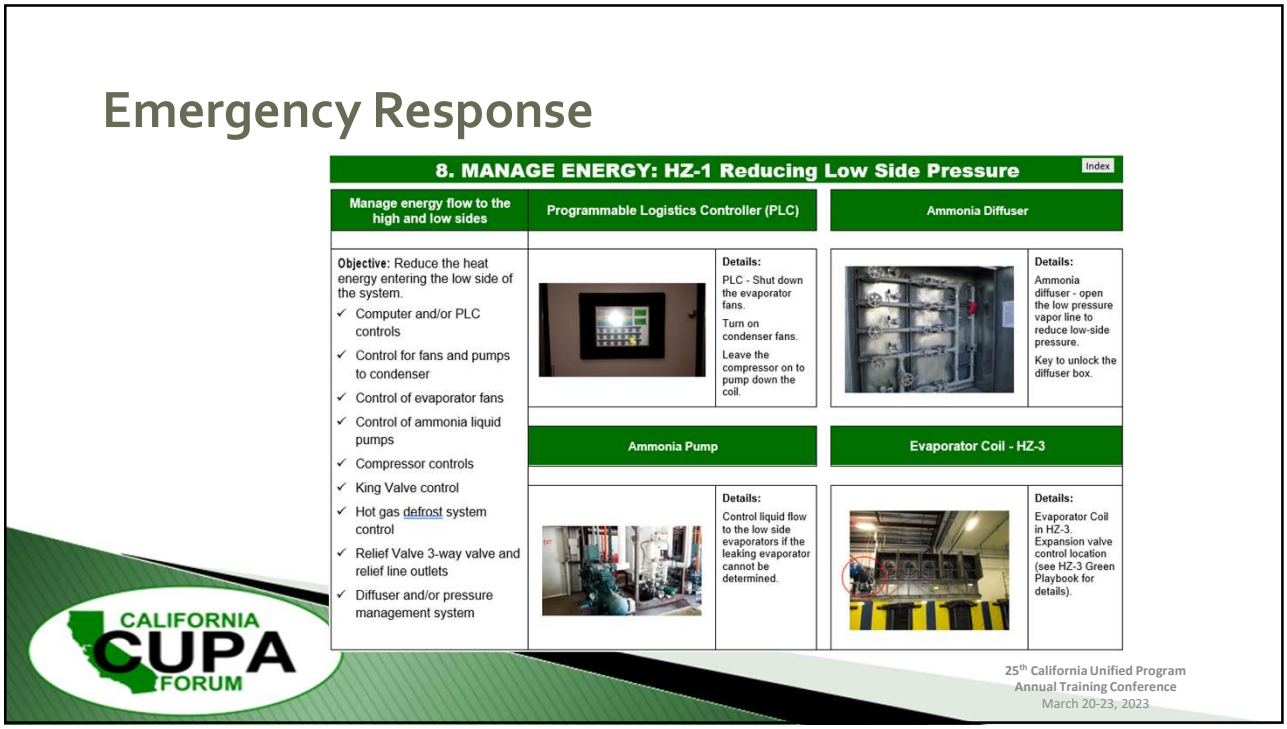

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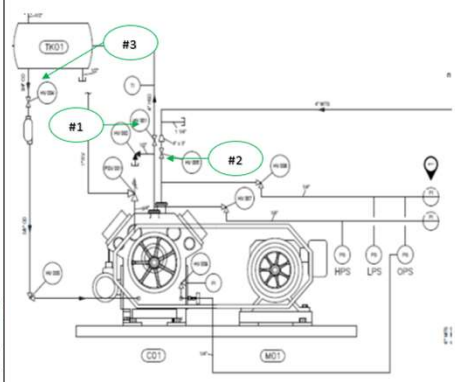
Emergency Response

1a. Control and Containment - P&ID and Picture for Compressor #1 Index

Diagram	Picture
	

Close the three valves:
1 = HV 001 = discharge valve
2 = HV 006 = suction valve
3 = HV 004 = Oil return line (need ladder to reach – ladder is located between boilers # 1 & 2)
Note: Three additional compressors (C-2, C-3, C-4) are controlled in the same fashion.

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Technical Assistance
CCR §2785.1

- The owner or operator of a stationary source shall closely coordinate with the UPA to ensure that appropriate technical standards are applied to the implementation of this chapter.
- The owner or operator of a stationary source shall request assistance from the UPA when necessary to address compliance with this chapter or safety issues regarding unfamiliar processes.

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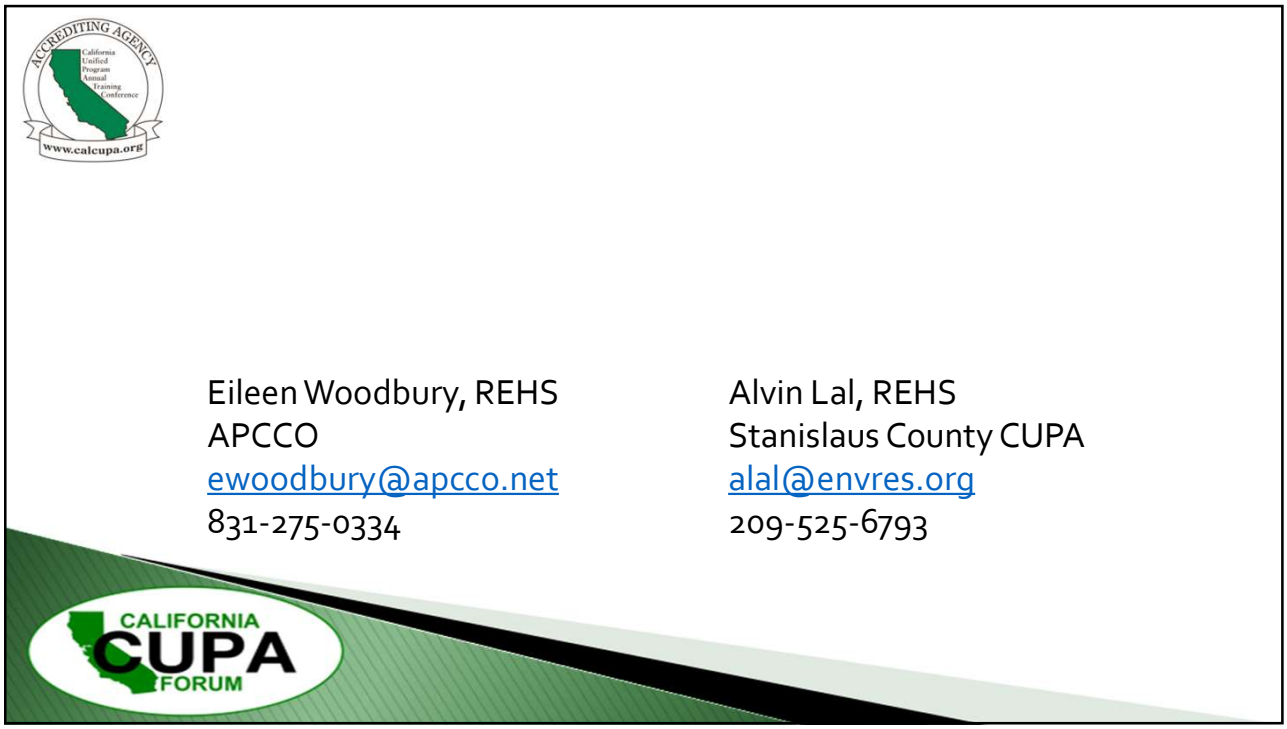

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