Maintenance & Safety Issues for Fluid Plants

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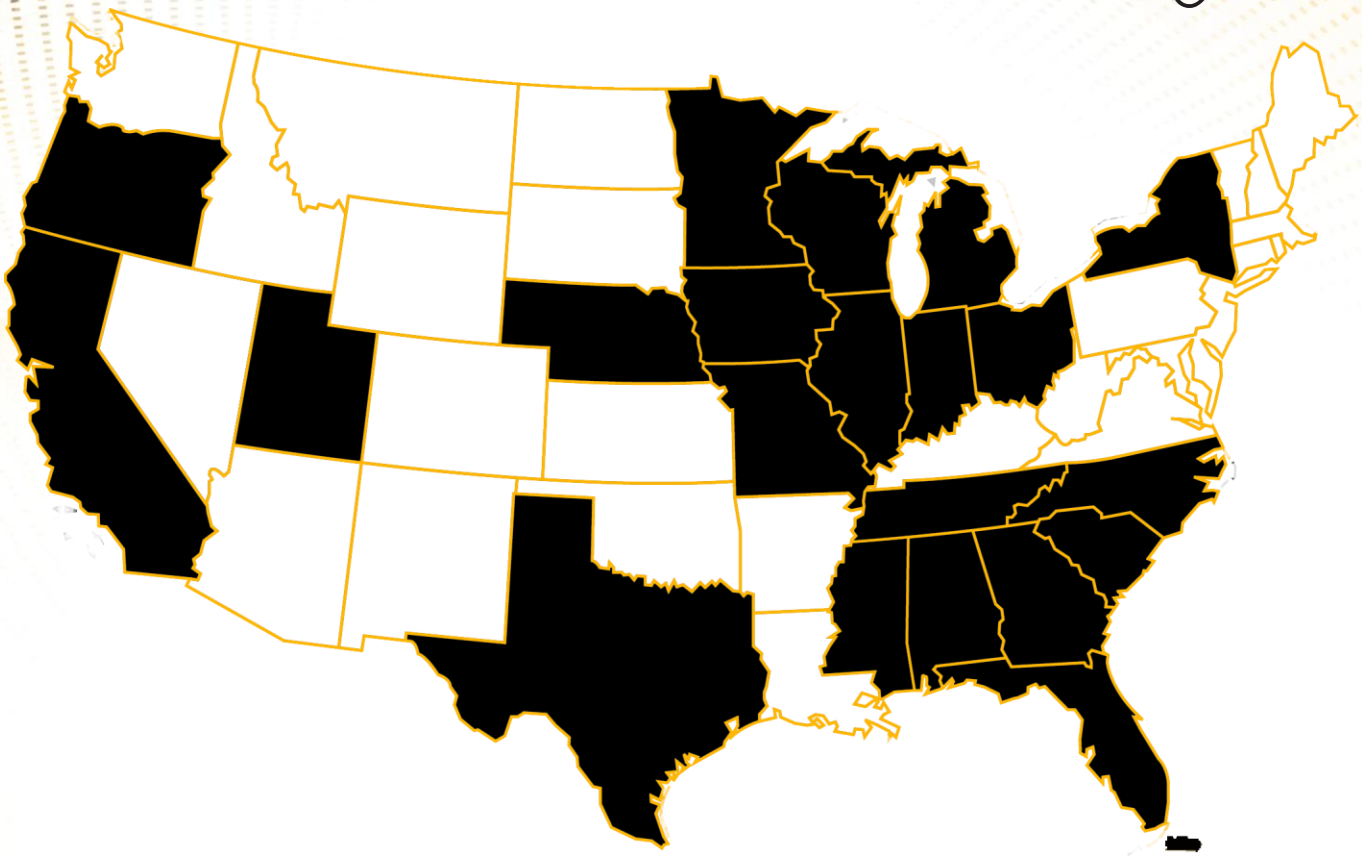
If you don't like something change it; if you can't change it, change the way you think about it. - *Mary Engelbreit*

Long Day – Headed Down the Home Stretch!

Safety-Exposure Identification

How many exposures can you identify in 30 seconds?

Who are we? Five Groups. One Company



The Andersons grows enduring relationships through extraordinary service, a deep knowledge of the market, and a knack for finding new ways to add value as we have done for nearly 70 years.

- Grain
- Plant Nutrient
- Ethanol
- Rail
- Retail

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Our Maintenance Approach

- **Reactionary Maintenance** - The equipment has failed and you have to fix it right now! If you have an installed spare it helps, but you must fix it immediately because you can't afford to run without a spare. This is the "norm" in most plants.
- **Preventative Maintenance** - You'll take appropriate actions and thereby prevent the unit from failing . Most companies are still trying to figure out what those appropriate actions are.
- **Predictive Maintenance** - By taking selected readings we hope to be able to predict an impending problem and calculate how much longer the unit will run before failure. A lot of information is being collected, but the concerned parties are still trying to figure out how to use it. Most predictive maintenance calls for shutting down the equipment when some arbitrary time limit has been reached and this puts you back to reactive maintenance again.
- **Continuous Diagnostic Maintenance** - You'll take constant readings and note any significant change in these readings. Hopefully you'll then be able to predict impending failure. This is very similar to reading the instruments on the dashboard of your automobile.
- **Machinery History** - By keeping good records we hope to predict the life of the unit or its individual components. This system assumes that the life of the previous unit somehow relates to the life of the present one.

What do we Measure?

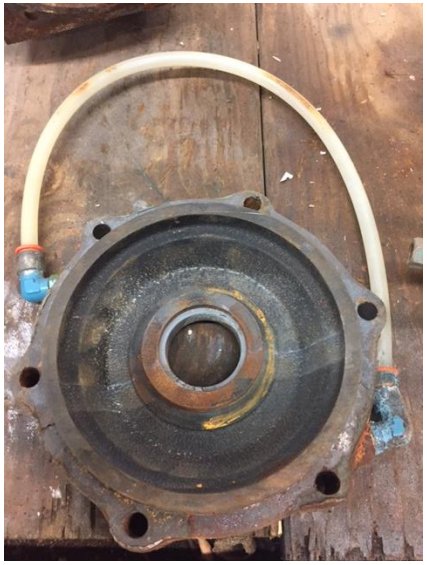
- **Heat** - Especially in the seal chamber and bearing case. A changing reading at the pump suction would be helpful in predicting cavitation. Volute casing readings could indicate internal recirculation and minimum flow problems as well as an indication of impeller rubbing.
- **Pressure** - You can take readings at the pump discharge, suction and stuffing box to determine where you are on the pump curve and see if you're within the operating range of your mechanical seal.
- **Speed** - To see how it affects pump curve data. The pump curves were generated with a variable frequency motor at a speed different than your induction motor.
- **Noise** - To indicate cavitation, rubbing, location on the pump curve, bad bearings, or some other abnormal condition.
- **Flow** - To check the status of wear rings, impeller adjustment and the discharge recirculation system.
- **Strain** - To anticipate rubbing and stress corrosion problems.
- **Liquid Level** - To anticipate flow and air ingestion problems.
- **Leakage and Fugitive Emissions** - To check the seal performance in both the stuffing box and bearing case locations.
- **Product contamination**- To monitor the performance of dual seals and flushing controls.
- **Power Consumption** - To check pump efficiency and to anticipate heat problems.
- **Vibration** - At multiple locations in the system to indicate that a failure has already started.

More Technical Measurements…

- **Clearances** - At the wear rings and bearing fits.
- **Dynamic balance** - of the entire rotating assembly or the individual components
- **Alignment** - Between the pump and the driver as well as the piping and the pump flanges.
- **Settings** - For the seal face loading and impeller clearance.
- **Shaft Deflection** - To insure that rotating parts will not contact stationary parts.
- **Shaft Axial Movement** - Especially equipment with sleeves or bearings. Both impellers and mechanical seals are sensitive to this movement.
- **Oil Analysis** - To learn if we are experiencing excessive wear or if our lubrication is breaking down. An 18 degree Fahrenheit (10 C.) increase in oil temperature will cut the service life of the oil in half.
- **X-Ray** - To detect cracks in metal, especially at the welds or to indicate evidence of Stress Corrosion cracking.
- **Thermal Imaging** - To detect rubbing and heat losses.
- **Magnetism** - Especially in the bearing area. Magnetized bearings or seals attract the metal particles found in worn lubricating oil.

Whilst on the Bench

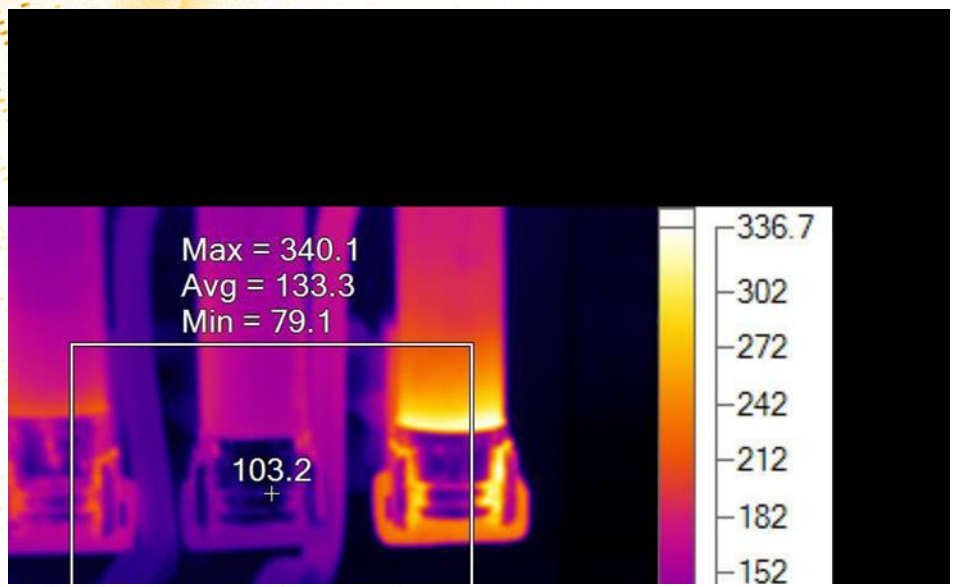
- Corrosion
- Discoloration
- Evidence of rubbing
- Damage
- Clogging
- Product attaching to the hardware
- The presence of foreign objects
- Missing parts
- Odd Smells/Discoloration
- Bearing Condition
- A wrong part



Basic Maintenance Issues

Problems

- Electrical Failures
- Failed electrical connection points due to corrosive nature of product.



Solutions

- Prior to season perform thermal scans of motors and electrical equipment to identify potential problems.
- Keep spare fuses on hand
- www.thermal.com
- Elevate pumps out of drip pans

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Basic Maintenance Issues

Problems

- Pump, gearbox, coupler alignment leads to pre-mature failure

- Corrosion of mild steel pipe and pin holes in heat affected zones

Solutions

- Ensure couplers for the motor and pump are aligned evenly and level across the top, bottom, left and right sides during installation. Provide adequate training.

- Keep pipe filled with product so oxygen is unable to enter and start corrosion process
- Replace with stainless steel pipe
- Inspect welds frequently especially at transitions where erosion can create pin holes

App Alert: "Harrington Chemical Compatibility Guide"

Basic Maintenance Issues

Problems

- Failure of air actuated valves- corrosion in air solenoid block
- Internal corrosion of mild steel tanks
- Loss or reduction of flow in loading lines

Solutions

- Make sure air is running through water separator or drier to prevent moisture accumulating in block
- Coat internal tanks with either epoxy or mineral oil and keep tanks as full as possible
- Keep filters, screens and strainers cleaned on a routine basis.
- Keep tanks cleaned to prevent the chance of drawing sludge of the bottom that will plug screens and filters.
- Limit the loading of materials with high salt-out temperatures in cold weather as these can salt-out in the line and eventually plug the line solid

Basic Maintenance Issues

- Use your resources and get outside the box with your training – For instance, local community college training opportunities may exist as well as government funding for training programs.

Spare Parts Approach

- Identify your critical spares (critical defined as a "will take you down" part)
  - Tip: Ask your accounting group if you can capitalize your spare until point of use
- How close is the part to the facility (how much downtime will a failure create)
- Stock them in a protected area away from corrosive items
- Ensure someone is trained to maintain and install these critical spares
- If you use a PM system, ensure your spare parts are categorized so they can be found and cycle counted easily
- Remember: the maintenance rules change if you fall under PSM/RMP

Safety, PSM and RMP

Best Practices and Resources for Retail Dealers

And Beyond

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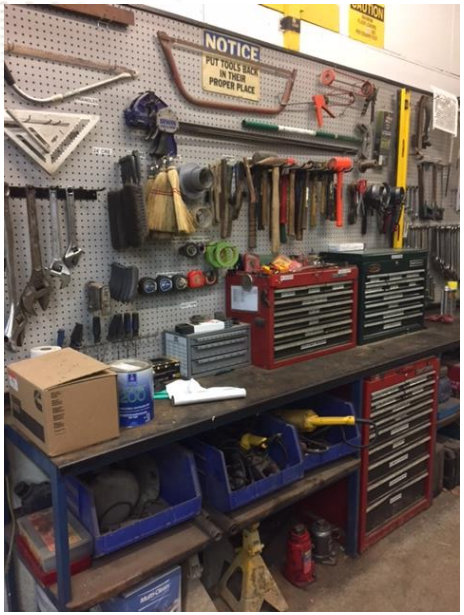
Housekeeping Best Practices



Scope Review

	Risk Management Plan (RMP)	Process Safety Management (PSM)
Agency	EPA	OSHA
Rule	40 CFR Part 68; section 112(r) of the Clean Air Act	29 CFR 1910.119
Focus	Prevent chemical releases from affecting **the public and the environment**.	Prevent chemical releases from affecting **employee safety**.
Implemented	June 21, 1999	May 26, 1997
Public Access	Yes	No
Agency Audit	Yes	*No (incident only)
Chemicals	77 toxic and 63 flammable Anhydrous Ammonia 10,000 lbs Aqua Ammonia (>20%) 20,000 lbs	130 toxic and reactive Anhydrous Ammonia 10,000 lbs Aqua Ammonia (>44%) 15,000 lbs

Maintenance

1. Retain or acquire copies of all equipment instructions; train accordingly
   - Installation
   - Operation
   - Maintenance
2. Validate contractor certifications
3. Keep detailed records (who, what, when)

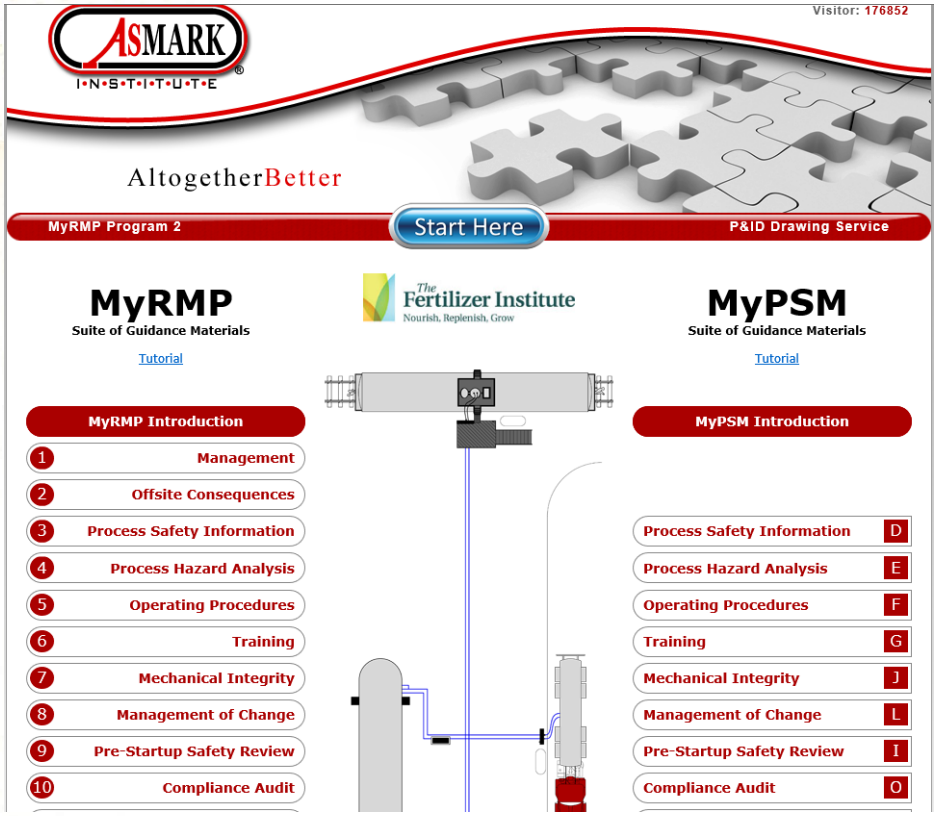
Training

1. Documented training matrix
2. Make sure to include SOP's in training
3. Document qualifications (and equivalent work experience)
4. Train contractors AND delivery drivers
5. Document external training and collaboration

Recordkeeping

1. Excel spreadsheet for logging incidents and near misses
2. List the record location & responsibility
3. Document calculations & assumptions
4. Document all follow up and corrective actions

Resources: Program Development



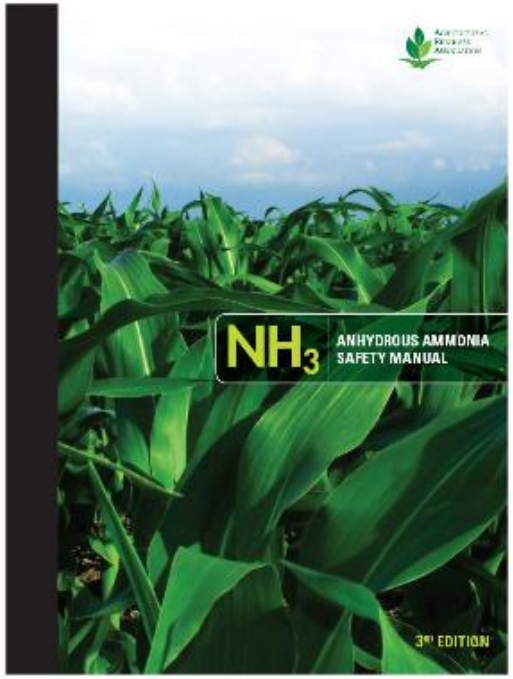
Resources: Procedures & Training

NH3 Safety Manual Pricing

$12.00 each

$25.00 Training Video DVD

To place an order please contact David McKnight at David@aradc.org or (202) 595-1710.



Resources: Training

Questions/Discussion Points

Safe travels home and Happy Holidays!