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# PSM/RMP COMPLIANCE

## MECHANICAL INTEGRITY - 40 CFR 68.73 & OSHA 1910.119(j)

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When sitting down to prepare your written Mechanical Integrity program for compliance with EPA's Risk Management Program, OSHA's Process Safety Management Program, or under the General Duty Clause, let us consult Webster's Dictionary to better detail what is meant by "Mechanical" and "Integrity".

- ▶ Mechanical: (a)(1) of or relating to machinery or tools (2) produced or operated by a machine or tool <mechanical power> <a mechanical refrigerator> <a mechanical saw> (b) of or relating to manual.
- ▶ Integrity: (1) firm adherence to a code of especially moral or artistic values (incorruptibility) (2) an unimpaired condition (soundness) (3) the quality or state of being complete or undivided (completeness)

Taking these definitions into account, we need to prepare a document that ensures the "soundness" of our mechanical refrigeration system.

Note that the basis for schedules, tests, and inspections (1910.119(j)(4)(iii)) are to include the following:

- ▶ Manufacturer's Recommendations
- ▶ Facility History
- ▶ Industry Standards (RAGAGEP)

**Manufacturer Recommendations**, is simple, ensure the preventative maintenance schedules include recommendations from the manufacturer. Pay particular attention to safety functions, i.e. compressor cutouts, ammonia sensors, etc.

**Facility History**, based on operating history, the preventative maintenance schedule can be altered to better meet the needs of the system.

**Industry Standards**, such as the International Institute of Ammonia Refrigeration (IIAR) suite of standards, includes frequencies for various visual inspections and tests, equipment installation, equipment decommissioning, etc. These items should be used in conjunction with or when no manufacturer's recommendations exist such as in the case of vessels and piping.

When incorporating visual inspection of pipes and vessels into your mechanical integrity program, corrosion or the potential for corrosion under insulation (CUI) is a major concern.

Corrosion is defined as "the deterioration of a material, usually a metal, by reaction with its environment."

The National Association of Corrosion Engineers (NACE) has identified some reasons and preventative measures for corrosion:

- ▶ An anodic-cathodic reaction
  - When positive ions travel through an electrolyte (i.e. water, ice, etc.)  
*Controlling water is essential!!*
  - When the material is sacrificed
    - general (uniform) corrosion
    - pitting corrosion
  - Gradual erosion of wall material
    - similar effect to sandpaper on wood
    - may be small pits present
    - Danger is from wall thinning sufficient to allow cracking.
  
- ▶ CUI is general corrosion that occurs undetected under piping insulation which can occur due to:
  - Water infiltrates the insulation system through a break in the jacket/vapor barrier.
  - Insulation then becomes an enabler which aids in corrosion by holding the water tight to the pipe.
  - Pipe must also be without or have a failure in the surface protection (i.e. pipe paint).

Issues associated with wet suction piping:

- ▶ Vapor sits in bottom of pipe.
  - Bottom is always frozen.
  - Top can freeze-thaw.
- ▶ CUI at mid-pipe or higher.
- ▶ Look for bottom frost/water.

Some thoughts on rust or corrosion preventative measures:

- ▶ Use of coatings that are impervious to moisture.
- ▶ Properly replace insulation, when repairs require removing existing insulation.
- ▶ Keep un-insulated metal surfaces painted.
- ▶ Use only tested and proven insulation/vapor barrier materials and methods.
- ▶ Include checking for rust and/or corrosion on system logs.

Other things to look for when conducting your mechanical integrity inspections whether at the five-year interval or sooner:

- ▶ liquid hammering (liquid slugging),
- ▶ vibration of pipe,
- ▶ equipment moving and/or shaking,
- ▶ pipe swaying,
- ▶ loud noises,
- ▶ pipe movement,
- ▶ ice build-up on evaporators,
- ▶ moisture accumulation on vessels or piping, and
- ▶ un-protected piping/equipment from fork lift or other vehicles.

