

# Mechanical Integrity for Ammonia Refrigeration Systems

by William Lape

Ever since the Process Safety Management (PSM) standard was promulgated in 1992, Mechanical Integrity, part (j) of 29 CFR 1910.119, has consistently been one of the most cited sections of the standard. For fiscal years 2014 through 2016, Mechanical Integrity was cited in 23.6% of all Chemical National Emphasis Program (NEP) inspections. In looking at the specific sub-elements cited during this same time frame, Mechanical Integrity occupied five of the top ten sub-elements cited. It is even more telling when we look at specific Chemical NEP inspections conducted in the Food and Beverage Sector, i.e. those that have ammonia refrigeration systems. In that sector during the same time frame, Process Safety Management was cited in 60.3% of the inspections with Mechanical Integrity making up 24.7% of the PSM citations for those facilities, second only to Process Safety Information at 25.4%.

So how do we avoid (ideally) or reduce these citations? The most common sub-elements cited within the Mechanical Integrity element are inspections and testing not being conducted at a frequency defined by Recognized and Generally Accepted Good Engineering (RAGAGEP), not having written procedures for the mechanical integrity inspections and testing, and equipment deficiencies not being corrected after being identified. Let's look at each one individually.

The first one that needs to be addressed is the failure to conduct inspections and testing at a frequency defined

by RAGAGEP. What is RAGAGEP, you ask? Simply put, for mechanical integrity, it is the defined inspection, testing, and maintenance (ITM) that industry considers to be recognized as acceptable to meet minimum safety standards. The PSM standard does not specify what is considered to be RAGAGEP. It is up to each facility or company to determine what their RAGAGEP is, not only for Mechanical

as many sections are not relevant to an ammonia refrigeration system. If choosing NB-23 as a portion of your RAGAGEP, you must specify which sections are NOT relevant and why. You don't need to prove relevancy, you need to prove irrelevancy. Some facilities have used American Petroleum Institute (API) standards in the past. This is discouraged in the ammonia refrigeration industry as

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Integrity, but also for design and operation of the system containing the highly hazardous chemical. For ammonia refrigeration equipment, many facilities have chosen to use the manufacturer's recommendations for their RAGAGEP for ITM. While this is a good start, it is incomplete. Most pressure vessel manufacturers do not specify specific ITM requirements. Valve manufacturers typically do not specify frequencies, although most do mention some form of inspection or maintenance. There are no manufacturer's recommendations for pipe.

So what to do? For pressure vessels and piping, a facility could choose to follow the National Board Inspection Code (NBIC) NB-23. However, care must be exercised if choosing to do so,

the API standards have little to no relevancy for ammonia refrigeration. International Institute of Ammonia Refrigeration (IIAR) and American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) standards have long been considered designated RAGAGEP for the ammonia refrigeration industry. However, our industry has historically been lacking in a standard for ITM. OSHA and EPA have long cited Bulletins 109 and 110 from IIAR as RAGAGEP for ammonia refrigeration ITM. However, they were never intended to be standards, rather guidelines. This will change soon as both Bulletins 109 and 110, along with 108 and 116 will soon be replaced by IIAR6, which is nearing publication. Once IIAR6 is published



as a standard, it will be considered the MINIMUM standard for ITM for our industry. There are many items within IIAR6 that have been added, so be sure to read it fully and conduct a gap analysis with your existing MI program. The takeaway from all of this talk about RAGAGEP is to be sure that it is fully defined and defended in your Mechanical Integrity element within your PSM program.

The next citation commonly found under Mechanical Integrity is a lack of written procedures for ITM. The only way to avoid this is to take the time to create the procedures within your program, once you have finished completely defining your RAGAGEP. For those facilities lucky enough to have a computerized maintenance management system (CMMS), this task is much easier to handle. These procedures don't need to be novels, but they do need to specify not only what steps need to be completed within each task, but they need to include a brief explanation of how to do so. In addition, documentation requirements must be explained in the procedures. Remember, if you didn't document it, you didn't do it.

Finally, the last item is the most difficult to take care of because it is an implementation deficiency that can be ongoing, rather than a documentation deficiency that can be rectified with some paperwork. When equipment deficiencies are identified, 29 CFR 1910.119(j)(5) states, "The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d) of this section) before further use or in a safe and timely manner when necessary means are taken to assure safe operation." While this is subject to interpretation as to what a "safe and timely manner" means, simply doing nothing is not acceptable. This is where employee participation through a PSM "team" comes in handy. Action lists with deficiencies should be reviewed periodically and updated with current estimated due dates, the responsible party for the action item, and notes as to what has been done so far. This is particularly important for those deficiencies that may require capital expenditures. Simply writing "waiting

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on corporate” is not acceptable to an OSHA or EPA inspector. However, in the case of a pitted pipe, writing that the pipe wall was verified to be above the minimum wall thickness for the pressures and temperatures at which it operates, that it was cleaned and painted upon discovery, and that it is being inspected every six months versus annually until capital funds can be approved to replace it go a long way to making sure that it is safe in the interim. The other thing to be mindful of is that past due dates on the action list or responsible parties that left the company six months ago, are typical fast lanes to citations, so be sure to review your action list frequently and keep it updated.

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