Aboveground Storage Tanks –

not just a wide spot on the pipeline

Owners and operators of pipeline facilities should ensure that storage tanks receive the same attention to potential corrosion as the pipeline itself. By contracting with experienced and knowledgeable tank manufacturers to combine their special expertise with equally qualified piping contractors, the owner/operator can ensure that all design considerations, including corrosion concerns are properly addressed throughout the system.

In separating the piping from the storage tank scope of supply on a pipeline facility, as is often contractually done, the piping contractor's engineer is not always fully aware of the various aspects of storage tank design and construction; just as the tank manufacturer is not necessarily aware of all the aspects of piping design. Such practice has led to some piping contractors' expressing (usually not seriously) the perception that the tank can be considered "just a wide spot on the pipeline". This, of course, is not true, even for corrosion considerations. Although corrosion mechanisms can be similar for tanks and attached piping, there are significant differences in how one detects, evaluates and remedies corrosion in a tank.

When a storage tank is properly designed and constructed, experience has shown that it can provide many years of trouble-free service, in some cases even with virtually no maintenance. Experience also shows that the major source of leaks in the petroleum industry is piping, and not tanks. However, owners/operators should not be lulled into a false sense of security by this experience or by the external appearance of the tank alone. Tanks need to be periodically inspected. Tank leaks unrelated to piping can and have occurred, sometimes with significantly more serious consequences, such as ground contamination due to long term small leaks or sudden catastrophic failure resulting from unchecked corrosion.

Since a tank may not exhibit evidence of detrimental corrosion or other service-related damage from its external appearance alone, it is necessary to internally inspect the tank in order to determine the type(s), location(s) and extent of such damage. A traditional impediment to this practice has been the typically great expense involved in removing the tank from service, cleaning it and making it safe for personnel entry. By contrast, piping sections can be isolated and inspected to determine their physical conditions with confidence at a fraction of the cost. And although progress continues toward reliable robotic and remote tank internal inspection methods, there are many conditions which simply cannot be assessed without physically looking at the inside of a tank.

An aboveground storage tank (AST) is vulnerable to four basic categories of corrosion. These are exterior or atmospheric corrosion, internal product corrosion, internal vapor space corrosion, and internal and/or external bottom corrosion. On any given tank,

depending on the product and conditions under which it is stored, the environmental conditions and the tank support material; there can be one or more of these types of corrosion occurring at any given time. Exterior corrosion, whether general or localized at crevices, is very easy to detect with an external inspection. Internal product corrosion is defined for this article as that due to a corrosive liquid phase of the stored product. Vapor space corrosion is that due to the vapor phase of the product. These types of corrosion, as well as that sometimes located at liquid/vapor interfaces, are difficult to fully identify with an external inspection, which is traditionally performed using a number of statistically averaged discrete measurement points. Bottom corrosion, which can be either or both internal or external, is the most difficult of all to map without a thorough internal inspection. API Standard 653, "Tank Inspection, Repair, Alteration and Reconstruction", prescribes the basic rules by which an owner should establish inspection intervals and extent of inspection to ensure safe tank operation. Inspection intervals are generally a function of the expected corrosion rate for the governing tank component. This Standard also provides guidance on measures to mitigate the risks of tank corrosion, including additional thickness allowance for corrosion, and by reference to complementary Standards, linings, coatings and cathodic protection.

How can the risk of tank corrosion problems be mitigated? For newly constructed tanks, the first and best precautionary step is to contract with a reputable and knowledgeable tank contractor (manufacturer). Although he or she usually has no control over the operational aspects of a tank, a reputable and experienced contractor can provide guidance on the most effective corrosion prevention measures available in the industry. The contractor should, as a minimum, have current working knowledge of the latest developments in Standards and regulations related to the tank industry. Preferably, the contractor should be proactively involved in the support and maintenance of industry standards, such as API Standards 650, 620 and 653; British Standard 2654; AWWA D-100; or others. Similarly, for existing tanks, the owner or operator should only contract with contractors who are, as a minimum, experienced with and knowledgeable of API Standard 653 requirements; and preferably those who include on their staff API 653 Certified Inspectors in responsible charge of this type of work. Such certified inspectors can generally be relied upon to have the necessary knowledge to address the many issues associated with the design, construction and maintenance of AST's, including corrosion prevention and remediation. In particular, the contractor selected should have a thorough working knowledge of corrosion related standards such as API Recommended Practice (RP) 651, "Cathodic Protection of Aboveground Petroleum Storage Tanks", API RP 652, Lining of Aboveground Petroleum Storage Tank Bottoms", and other similar standards. As with all vibrant industries, technological advances and the availability of better tools continues in the petroleum industry. Reputable contractors will stay abreast of these advances. Soon to be published API RP 579, "Recommended Practice for Fitness-For-Service" is one such new tool relevant to the evaluation of corrosion (and other damage) of tanks and other structures. RP 579 is a publication under final development in API, which is intended to supplement and augment the requirements of API Standard 653, as well as those of API Standard 510 and API 570. In addition to being directly applicable to API 650 and API 620 tanks, it is also directly applicable to ASME B31.1 and B31.3 piping and ASME Section VIII pressure vessels. Thus it will

provide a consistent basis of corrosion assessment for the entire pipeline facility. In terms of corrosion evaluation, RP 579 will be particularly useful as it will provide assessment procedures for general metal loss, local metal loss and pitting type corrosion. Three levels of assessment will be available. The first level is the simplest, requires the least amount of data, and is theoretically the most conservative. The third level is the most sophisticated (engineering intensive), requires the most amount of measurement and other data, and is considered the most accurate. The second level can be characterized as a compromise between the two extremes. The guidelines provided in API RP 579 can be used to make run-repair-replace decisions to ensure that pressurized equipment containing flaws, such as corrosion, which have been identified by inspection, can continue to operate safely. Owners and operators of pipeline facilities should follow these industry standards to ensure that tanks, along with piping and other equipment, are periodically inspected and evaluated to minimize the risks associated with corrosion. By contracting only with contractors qualified as described above, the owner can be assured that his operational budget is allocated in the most cost-effective manner possible for the long term.

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