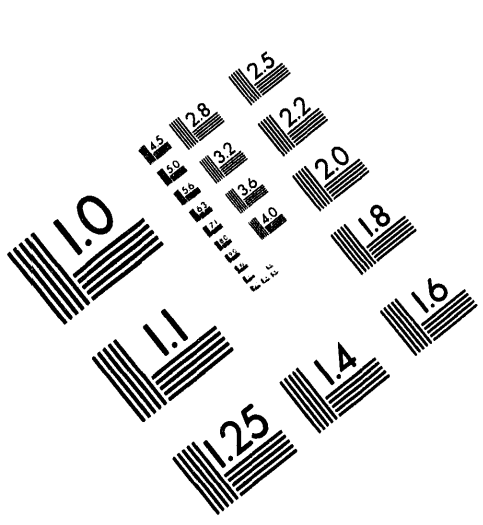

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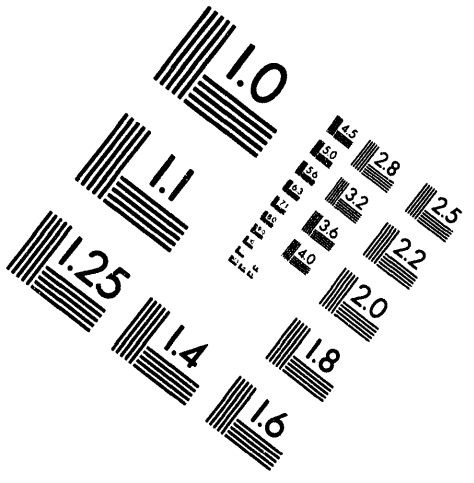

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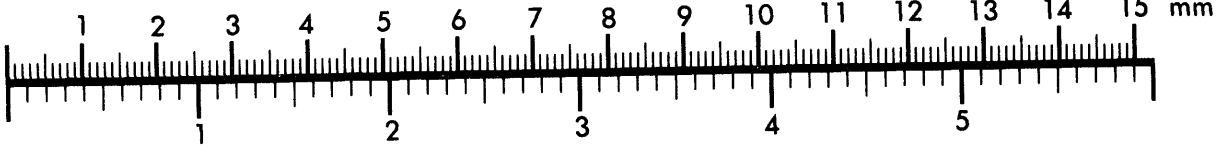

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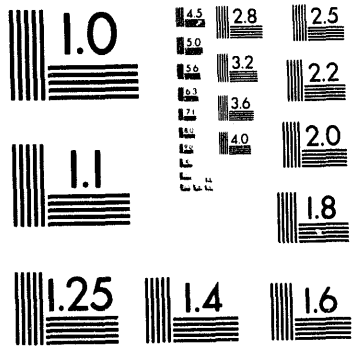

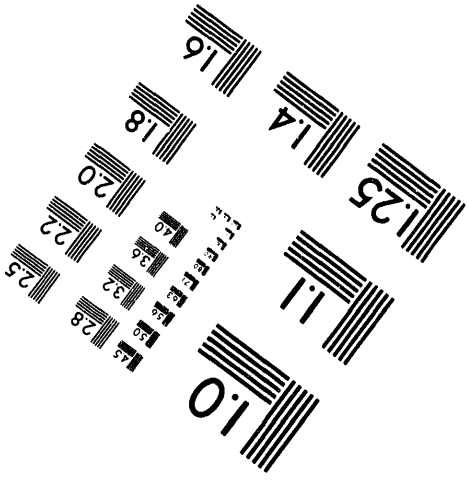

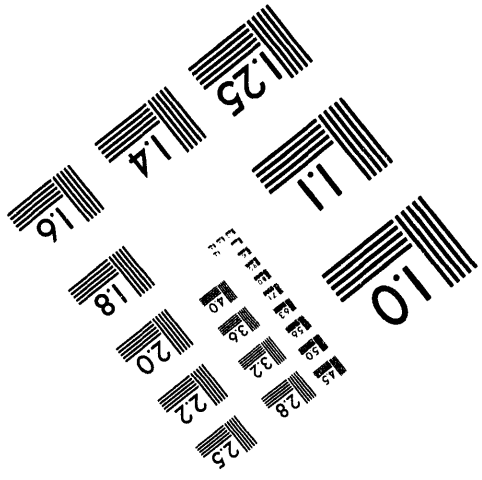

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Title: Engineering Management of Underground Storage Tank Upgrades and Installations

Author: Paul(Prashant) B. Patel

Disclaimer: This technical paper is written by the author based on his work experiences about the subject from previous and current place of employment.

ABSTRACT

Remediation of Leaking Underground Storage Tanks (LUST) is estimated to cost more than $41 billion in the United States. As of May 1992, 1.5 million Underground Storage Tanks were registered in USA. By September 1992, 184,000 confirmed releases (leaks) were reported in USA. Due to such a vast impact on the environment due to leaking USTs, United States Environmental Protection Agency (USEPA) published final UST regulations in the Federal Register on September 23,1988 (40CFR Part 280) which affected almost every commercial underground storage tank (UST). In a rush to comply with UST regulations, it is important that sufficient attention has been paid to engineering aspects of the work. Due to wide array of UST leak prevention and detection products available, selection of appropriate instrumentation can be time consuming.

Most states have taken federal government standards on USTs and incorporated them as state regulations with their state specific modifications depending on their local geological conditions and environmental priorities. However, it is important to find out that state's UST program has been approved by USEPA. This paper consists of discussion of issues based on the author's UST project related experience from current and previous employment. Following are the major UST related regulatory topics discussed in this paper:

* Specifications
* Hiring a contractor
* Piping Selection and Installation
* UST Selection and Installation
* Leak Detection System
* Environmental Sampling

Engineering Specifications

One of the most important tasks for UST upgrades would be the preparation of thorough engineering specifications. Based on the task and equipment specified in the specifications, cost for the project will vary. Detailed specifications will not only

make it easier for bidders to estimate the cost, but they will reduce the last minute problems once the work begins. Specifications also provide necessary tools for litigation against the contractor should the situation arise. Several engineering and practice standards are frequently used to specify a task or equipment in specifications. Typical standards often referenced in engineering specifications for UST upgrades are from agencies such as American Petroleum Institute (API), American National Standards Institute (ANSI), National Fire Protection Association (NFPA), Underwriters Laboratories (UL), etc..

Collection of field notes are recommended during the course of UST work. This activity is normally undertaken by the owner's engineer or by an consulting engineer. Detailed field information can be valuable at a later time should any questions arise from the management or regulatory agencies. Site photographs are also a valuable tool for records. Often overlooked and undervalued, preparing precise as-built drawings will provide valuable information for the type and locations of USTs its related piping and electrical conduits. As-built drawings can especially be useful in the future when there is a change in personnel who were originally involved with the project and thereby leaving a void in corporate knowledge in terms of available historical information. Burden of obtaining all necessary permits from local fire marshall, township and state should be determined at early stage. Engineering specifications can essentially dictate the entire UST job, and therefore, following are some of the topics which can be incorporated in specifications or dealt with separately.

Hiring a Contractor

Though, most companies have their own unique way of procuring appropriate contractor, few points are worth noting here. Prior to work award, check with the bidder for three recent similar work references. Make sure the bidders have sufficient liability insurance and all project personnel are properly trained and certified under the state UST regulations. Some states have certification requirements for each aspects of UST upgrade tasks. In certain cases, a contractor with good work reputation may underbid others due to lack of any work backlog. Such actions may win the contract but is likely to tempt the contractor in cutting corners on the work and therefore, provision of an independent resident engineer may be worthwhile to oversee the contractor for compliance to technical specifications and applicable environmental regulations. The method for removal of existing UST and piping should be specified to address issues such as vapor venting, health & safety of work crew, stability of excavated area and nearby structures, underground utilities Many UST contractors lack the expertise and finesse required to address the required environmental sampling and reporting requirements, especially if a release is discovered during the upgrade activities. One way to manage the upgrade project is to hire an environmental engineering consultant to prepare the Request for Proposal and let consultant select and negotiate with the UST contractor. Also, make consultant responsible for

overseeing the UST upgrade work, environmental sampling and reporting.

Piping Selection & Installation

Two thirds of all UST reported leaks are known to occur at its related piping and joints. Though state UST regulations may or may not require, more and more steel pipes are being replaced by double wall fiberglass reinforced plastic (FRP) pipes. A common FRP pipe brand name is Ameron Dualoy 3000/L (UL certified for specific pressure loads). FRP pipes are currently common in use for fluids such as gasolines, diesel, heating oils etc.. Compatibility of FRP with fuel of storage should be checked with the pipe manufacturer.

Design of double wall FRP or other pipes and their trench design need to be detailed in engineering specifications and their installation supervised. The pipe trench may need to be lined with geotextile in sandy soil areas so that the trench backfill material such as pea gravel is contained within the trench area and do not settle away from the pipe. Also, depth of the pipe should be sufficient enough for protection against the freezing of the product inside the pipe and to provide structural integrity against any vibrations caused by the above ground vehicular traffic. A depth of at least three feet or more from grade is desired for UST so that sufficient piping slope towards the UST can be maintained as well as sufficient depth of pipe is attained at the opposite end near the dispenser. All joints for fiberglass reinforced pipes must be cured following manufacturer's instructions. Use of curing (heat) packs must be used in cold weather to ensure sufficient curing temperature and bonding of pipe joints. One of the several ways of inspecting piping for any leaks upon installation is by pressurizing both inner and outer piping with air and checking for any pressure drop in specified period of time and also using soap bubble technique for all joints.

Underground Storage Tanks

Under the current federal and state UST regulations, variety of USTs can be used as long as certain minimum leak detection and prevention objectives are met. Though, double wall fiberglass reinforced plastic tanks are common in use, fiberglass coated double wall steel tanks are also available. Single wall steel tank may also be used as long as cathodic protection is provided to the UST. Factors of consideration during UST selection are: surrounding water table, corrosivity of soil, geological conditions, chemical characteristics of the product to be stored, etc..

USTs should be sufficiently anchored all the time. Without appropriate anchors, installed USTs or partially exposed USTs during upgrade activities can easily float aboveground during heavy rains and floods. For FRP tanks, anchor cables must be placed only at the specified locations by the manufacturer otherwise damage to UST is likely to occur.

Prior to installation of new USTs, preliminary leak check is performed by pressurizing

both inner and interstitial space of the UST at about 3 and 5 psig respectively. UST is normally pressurized for overnight and checked for any drop in pressure.

Leak Detection System

Besides doublewall ranks and pipes, leak detection system is the primary aspects of UST upgrades. Their principle function is to monitor for loss or detection of product by using combination of techniques such as electronic sensors, level indicators, and manual inspections. Different units available to create a site specific leak detection system include: Liquid & vapor sensors, monitoring wells, observation wells, cathodic protection, doublewall piping & USTs with sumps, in-tank liquid-level and temperature monitors, etc. Leak detection method requiring low capitol investment such as periodic manual inspection and inventory measurements with periodic tank tightness and integrity tests could be an short term option. Overfill containers (typically, of five or fifteen gallon size) are required to be fitted above the filling port of the UST to prevent overfill spill in to the environment.

Since many of these leak detection electronic products are relatively new in the market, their reliability and engineering soundness need to be looked at over the life of USTs. Liquid and vapor sensors placed in the annular space of doublewall pipes or sumps may cause false alarms due to moisture condensation or slight presence of product vapors in the nearby environment due to their high sensitivity. If cathodic protection is installed on piping or USTs, impacting factors such as presence of nearby electric currents, size and type of sacrificial anode, exothermic welding of wire connections and use of galvanic method or impressed current system should be evaluated.

Environmental Sampling

Depending on the individual case, environmental sampling can be performed either by the same contractor or an independent environmental consultant. Environmental sampling is generally required when existing tanks and related piping are upgraded, replaced or abandoned in place as part of the closure. Closure of old piping by removal or in-place abandonment will generally require soil sampling at periodic distances. Similarly, number of environmental samples required for old UST closure will depend on the length and size of UST, surrounding geological conditions and nature of the product stored. Based on the assumptions that no substantial soil contamination will ne found during excavation, cost of environmental sampling should be estimated prior to mobilization of work. If soil or groundwater contamination is suspected or detected, than the owner of the UST is not only required immediately to report the release to appropriate state agency (generally in 24 hours), but the owner is also required to commence the remedial corrective actions within a certain time frame. Selection of sample analytical parameters such as BTEX (Benzene, Toluene, Ethyl Benzene and Total Xylenes), Volatile Organics Analysis (VOA) and Total Petroleum Hydrocarbons (TPHs) depend on the type of petroleum product such as gasoline, diesel or heating oils stored in the UST. Due to vast scope of this topic, its

discussion is limited in this paper.

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