

CITY OF BAKERSFIELD UNDERGROUND STORAGE TANK LINING PROCEDURES



Industry Codes - Consensus Standards

Informational Sources:

API 1631 "Interior Lining of UST's"
UL 1856 "Outline of Investigation for UST Lining Systems for Petroleum"
UFC 79-6 "Interior Lining of UST's"

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GENERAL STEP-BY-STEP TANK LINING PROCEDURES

- 1) **SITE ISOLATION/PREPARATION**
- 2) **EXCAVATION TO TANK**
- 3) **TANK ISOLATION**
- 4) **PURGING FLAMMABLE/COMBUSTIBLE VAPORS**
- 5) **OPENING THE TANK**
- 6) **TANK ENTRY**
- 7) **INITIAL TANK INSPECTION**
- 8) **TANK CLEANING**
- 9) **SURFACE PREPARATION**
- 10) **FINAL INSPECTION**
- 11) **APPLICATION OF THE LINING MATERIAL**
- 12) **TESTING OF THE LINING MATERIAL**
- 13) **CLOSING THE TANK LINING ACCESS OPENING**
- 14) **AIR TEST OF THE ACCESS OPENING SEAL**
- 15) **RESURFACING THE EXCAVATION**
- 16) **REINSPECTION OF THE LINING WITHIN 10 YEARS AND EVERY 5 YEARS THEREAFTER**

The above steps (1-16) must be performed in accordance with NLPA (National Leak Prevention Association) Standard 631, API (American Petroleum Institute) Recommended Practice 1631 of UL (Underwriters Laboratories) 1856, AND local fire regulations. In addition, other federal, state and local regulations may apply.

CONTRACTOR QUALIFICATIONS

Tank lining contractors will be entering confined spaces, handling toxic and flammable chemicals, and potentially affecting the safety and well being of anyone within the vicinity of the tank lining operation. A qualified tank lining contractor will have the proper training and experience to eliminate any possible harm to site personnel, the environment and the surrounding public.

TRAINING:

A properly trained contractor can provide documentation of:

- 1) Initial 40 hour HAZWOPER training and the most recent 8-hour HAZWOPER refresher course for each of his employees needed on site;
- 2) Confined space safety training for all site personnel; and,
- 3) Any specific training required by the tank lining material manufacturer.

EXPERIENCE:

A properly experienced contractor will be able to:

- 1) Provide several references where similar work has been performed;
- 2) Coordinate activities with other contractors on site;
- 3) Schedule the services of other necessary service providers (such as special inspectors); and,
- 4) Obtain necessary permits.

PAPERWORK:

A prepared contractor will have:

- 1) Standard Operating Procedures;
- 2) A written Safety and Health Program;
- 3) Confined Space Entry permits; and,
- 4) The proper equipment and personal protection necessary to do the work in a safe and effective manner.

SITE PREPARATION

In order to perform his work safely and effectively, a tank lining contractor must take control of the site. Only the contractor can make the determinations necessary to guide placement of barricades and routing of traffic on site which are necessary to protect his employees and the general public in the vicinity of the site. In some instances, it may be perfectly all right to allow the facility to remain open. In other cases, the proximity of tanks to pump islands or traffic corridors, the size of a site, and even the weather can make it impossible to allow operation of the facility during the tank lining procedure. In any instance where the facility is to remain in operation, the tank lining contractor needs to consult with the owner or manager to ensure safety.

The minimum steps of site preparation include making arrangements for:

- 1) An equipment staging area.
- 2) A barricaded zone with no unauthorized entrance.
- 3) Control of access to electrical circuits leading to tank accessories and associated pumps.
- 4) Minimum necessary excavation size (usually 5' x 5').
- 5) Routing of traffic on site.
- 6) Scheduling of pump outs and fuel deliveries.
- 7) Noting the presence of manifolded lines (vents, siphons) and the most appropriate method for providing isolation of existing manifolded lines.
- 8) Checking that the prevailing wind direction will not cause potential hazards to site personnel or to the general public.
- 9) Changes in work procedures expected due to weather conditions forecast at a site.
- 10) Approximate depth to ground water.

TANK OPENING CONSIDERATIONS

Prior to tank opening, the tank liner needs to assure that all equipment which could build a static charge is properly grounded. The following equipment must always be grounded:

- 1) Fuel Transfer Pumps.
- 2) Ventilation Devices (educators, diffusers, fans).
- 3) Steel Tanks.

Electrical supplies must be locked out. Devices which must be electrically isolated include:

- 1) Submersible Pumps.
- 2) Line Leak Detectors.
- 3) Automatic Tank Gauges
- 4) Dispensers.

(Note: simply turning these devices off is not enough! Improper wiring and unauthorized access can cause an accidental energization of this equipment).

Other preliminary considerations include:

- 1) Potential sources of ignition are to be removed from the vicinity prior to tank opening.
- 2) It may be necessary (or advisable) to monitor the excavation above the tank prior to personnel entry for oxygen and flammable vapor content.
- 3) Oxygen readings must be between 19.5% and 23.5%.
- 4) Flammable/Explosive vapors must not read greater than 5% of the lower explosive limit (LEL) and must be recorded every half hour.
- 5) Only non-sparking or pneumatic tools are to be used for cutting an access opening to a tank.
- 6) Cutting tools may need to be lubricated or cooled with a water stream to further reduce heat and sparks from friction.
- 7) A minimum of two 80-BC rated fire extinguishers are to be available near the excavation during cutting.

TANK OPENING PROCEDURES

- 1) Mark the area to be cut

Note: The following are the minimum dimensions for tank openings under current standards:

American Petroleum Institute:	1631 22" x 22"
National Leak Prevention Assn.:	631 22" x 22" or 24" diameter
National Fire Protection Assn.:	326 22" x 22" or 24" diameter
Uniform Fire Codes 79-6:	24" x 36' or 36" diameter

**It is important to avoid cutting through any fabrication seams when cutting an access opening.*

- 2) Confirm that oxygen and flammable vapor concentration measurements have been made immediately prior to cutting.
- 3) Drill a hole at one corner or along the perimeter of a round cut using a pneumatic drill and cutting oil.
- 4) Measure the oxygen content and flammable vapor concentrations through the hole drilled in step 3 above.

Oxygen must be between 19.5% and 23.5%.

Flammable vapor concentrations must not be greater than 5% of the LEL.

- 5) Cut along the mark using either a pneumatic saw lubricated with cutting oil or a non-sparking cutting tool such as a snipper.
- 6) Be careful to support the piece of metal being cut from the tank to prevent it from falling into the tank upon completion of the cut.
- 7) Contractors will be required to make log entries every hour on LEL readings. This log will be maintained while access openings (man ways) are open. Our inspector will verify log entries.

TANK ENTRY

- 1) Initial tank entry is not to be performed until oxygen and flammable vapor concentration measurements have been made at the access opening over all levels of the tank.
 - Oxygen must be between 19.5% and 23.5%.
 - Flammable vapor concentrations must not be greater than 5% of the LEL.
 - Constant ventilation must be provided during entry.
- 2) Walking through or standing in liquid residual product is not an acceptable practice. Oil absorbent material is introduced through the access opening to dry any visible liquids immediately below the access opening.
- 3) The ladder used for entry must be made of non-sparking materials.
- 4) The minimum personal protective equipment ensemble must include:
 - SCBA or air-supplied respirator with escape SCBA
 - Chemical boots
 - Chemical gloves
 - Oil resistant coveralls treated to reduce static
 - Harness and Lifeline
 - Hard hat (if not part of respirator hood)
- 5) If the tank is greater than 5 feet in diameter, the life line must be attached to a mechanical means for retrieval.
- 6) The minimum number of people necessary to perform entry is three:
 - The Entrant
 - An Attendant (Standby Person)
 - A Supervisor
- 7) Appropriate monitoring instruments are used to determine that acceptable air monitoring readings are obtained throughout the tank, drying any liquid residual product which remains in the tank with additional oil absorbent.
- 8) Once the atmosphere has been confirmed to be within acceptable limits, a non-sparking shovel and buckets are used to remove any residual product.
- 9) Oil absorbent is swept around the tank to further dry the tank surface.

ABRASIVE BLASTING

Surface preparation is the single most important aspect of any coating work. The thicker the coating to be applied, the more important surface preparation becomes. There are two categories of surface preparation which need to be considered:

- Degree of Surface Cleaning
- Anchor Profile

DEGREE OF SURFACE CLEANING:

The application of a tank lining material to the walls of a steel underground storage tank requires a white metal surface. A white metal surface is a surface that, when viewed without magnification, is free of all rust scale, oil residues, mill scale, coatings and debris. The metal should have a consistent gray appearance with very little, if any, staining. Factors which influence blast cleaning are:

- Tank Condition
- Surface Area Size
- Experience of Personnel
- Type of Abrasive Used
- Amount of Abrasive Used

ANCHOR PROFILE:

Anchor profiling results from the impact of the abrasive on the metal surface, producing a rough surface texture. This rough surface texture allows the tank lining to better adhere to the tank by preventing lateral movement and by increasing the surface area of lining material/metal interface. In order to achieve the anchor profile necessary for tank lining, there are two factors to consider:

- Abrasive Size
- Nozzle Pressure

* Tank lining requires an abrasive with a minimum 18 mesh grit size.

* The minimum nozzle pressure for blasting is 90 PSIG.

* The abrasives typically come in 100 pound bags.

CERTIFIED STRUCTURALLY SOUND

Tanks cannot be lined until certified structurally sound. The special inspector will do the following:

- Ultrasound Thickness Test
- Special Inspector Sound Perforations with a Ball Peen Hammer
- Special Inspector Inspects for Defects: Compare against Criteria; Repair if Necessary
- Certification Provided by Special Inspector

GENERAL GUIDELINES FOR POUNDS OF ABRASIVE AND LINING MATERIAL GALLONAGE

TANK SIZE	ABRASIVE USED 1 Bag = @ 100 Lbs.	GALLONS OF MAERIAL + (For nominal 125 mil thickness)
12,000 gallon	24-26 bags	70.4 gallons
10,000 gallon	20-22 bags	62 gallons
8,000 gallon	18-20 bags	54.5 gallons
6,000 gallon++	15-18 bags	48 gallons
4,000 gallon	14-16 bags	42.2 gallons

* The amount of abrasive used to attain a SSPC SP5 white metal surface with an anchor profile of 3 mils or greater depends on many factors including:

- Personnel experience
- Presence and amount of "blue" metal
- Configuration of the tank

** Different tank configurations may require slightly more or slightly less tank lining material to be applied. Also, the above figure includes a very slight shrinkage factor. A material which is applied as a 100% solid may require slightly less material and a material which has a high volatile concentration may require more to attain a 125 mil nominal thickness.

*** Tanks smaller than 4,000 gallons are not typically lined except when the smaller tank is part of a site which has larger tanks which are to be lined.

+ Tank lining material manufactures usually supply tank lining materials in one of the two following ways:

Units

- Slightly more than 4 gallons each
- Usually for 2 part epoxy materials

55 gallon drums

- Each contains approximately 50 gallons
- Used with externally catalyzed spray resins

++ 6,000 gallon tanks vary widely in configuration. Thus, the amount of abrasive and tank lining material necessary to properly prepare the tank can also vary considerably.

ADHESION:

This is a measure of the lining material's ability to remain attached to the tank interior surface. When tanks are emptied and filled, they change shape causing the tank walls and end caps to flex. A tank lining material needs to maintain attachment to the tank walls in order to perform properly.

FILM INTEGRITY:

This is a measurement of the effects on the outermost surface of the lining material to contact with the stored product. Effects can range from severe effects such as softening of the lining material surface to typically inconsequential effects such as discoloration. The testing laboratory must determine whether changes in film integrity measurements indicate problematic effects or whether the effect is unimportant or even beneficial.

COATING EXPERT

After tank has been lined the coating expert will:

- Do a Visual Check
- Thickness
- Hardness
- Steel Tank Holiday Resistance Test
- Vacuum Test
- Certifies Tank is Suitable for Continued Use for at Least 10 Years
- Written Certification of Inspection Sent to Our Office within 30 Days

TANK CLOSURE

The Contractor Information is submitted to our office for review and approval along with:

- Special Inspector Report
- Coating Expert Report
- Lining Contractor Qualifications & Certification
- Third Party Certification and Tank Lining Materials Process

PRIOR TO FINAL

- Perform Tank and Piping Integrity Test
- Install/Use Approved Monitoring Equipment LG 113 Series
- Update the Monitoring and Response Plan
- Cathodic Protection System Using Voluntary Consensus Standards (API 1632)
- Cathodic Protection Requirements

CATHODIC PROTECTION REQUIREMENTS

If the exterior surface of the tank is unprotected from corrosion, the tank must be retrofitted with cathodic protection by December 22, 1998. However, if the lining applicator or special inspector notices corrosion during the lining process, then the tank must be retrofitted with cathodic protection before the UST is returned to service.

Cathodic protection systems that are retrofitted on existing tanks must be designed by a corrosion specialist. A corrosion specialist must be certified by the National Association of Corrosion Engineers (NACE) or be a qualified professional engineer. Cathodic protection systems must be tested by a qualified person within six months of installation and at least every three years thereafter. The purpose of these inspections is to ensure that the tank and piping maintain proper corrosion protection in accordance with voluntary consensus standards (such as NACE-02-85 or API 1632). In addition, impressed current cathodic protection systems must be checked every 60 days to ensure that they remain in proper working order. Cathodic protection systems must be checked within six months of any construction in the vicinity of a cathodically-protected UST if the construction could have affected the cathodic protection system. This is to verify that no damage was done to the electrical system.

If piping connected to the tank is single-walled, constructed of steel, and it is not replaced with new double-walled piping, then the cathodic protection system must also protect the piping from corrosion. Stainless steel, galvanized steel, coated steel piping, and wrapped steel piping are not considered corrosion-protected, and therefore, must be replaced or upgraded with cathodic protection by December 22, 1998. Other metal components of the UST system (such as submersible pumps) that routinely contain fuel and are in contact with the ground must also be cathodically-protected by December 22, 1998.

WHAT FUTURE TESTS ARE REQUIRED OF THE INTERIOR LINING AND TANK SHELL?

Within 10 years of the lining, and every five years thereafter, a coatings expert must conduct an evaluation of the tank and lining. A special inspector (i.e., qualified professional engineer) may do this in lieu of the coatings expert. Depending on whether the tank is steel or fiberglass, the evaluation must include: cleaning, visual inspection of the interior, interior diameter measurements, ultrasound thickness test of steel walls, thickness test of lining, hardness test of lining, electrical resistance holiday detector test, and a vacuum test. After the evaluation, the coatings expert or special inspector must certify one of the following:

- The tank is suitable for continued use for a minimum of five years.
- The tank is suitable for continued use for a minimum of five years only if it is relined or other necessary improvements are made.
- The tank is no longer suitable for continued use and must be closed immediately.

IF A SINGLE-WALLED TANK WAS LINED PRIOR TO THE
ADOPTION OF THE STATE'S LINING REQUIREMENTS, WHEN
DOES IT NEED TO BE INTERNALLY INSPECTED?

If a tank was lined prior to August, 1991 then it must be internally inspected by December, 1998 in order to determine that the tank shell and lining meet the upgrade requirements. However, if a tank was lined prior to August, 1991 and it can be shown that interior lining was conducted in accordance with the lining requirements that become effective in August, 1991 then the internal inspection is not required until 10 years after the lining was applied.

DO TANKS THAT HAVE BEEN LINED NEED TO BE MONITORED
FOR LEAKS?

Yes. Tanks that have been lined and connected piping must be monitored for leaks in accordance with Article 4, Title 23, CCR. The requirements for monitoring lined tanks and connected piping are the same as those for monitoring single-walled tanks and piping that have not been upgraded.