



Underground Storage Tank Flood Guide



Junction, Texas Flood of 1935. Photo courtesy of Texas Escapes Online Magazine and Texas Department of Transportation

Contents

Introduction	1
Effects Of Flooding On Underground Storage Tank Systems.....	2
What If An UST Is Located In A Flood Area?	4
Before A Flood, What Should Owners And Operators Do?	6
After A Flood, What Should Owners And Operators Do?	7
What If A Tank Floats Out Of Its Excavation?	8
What If A Remediation System is Flooded?	9
Other Useful Information	10
Incident Response.....	11
Financial Assistance.....	11
References.....	14
Appendix A – API Checklist.....	16
Appendix B - Selected State Information On Returning Flood Impacted USTs To Service	17

Introduction

Floods are caused by many different phenomenon including natural processes such as heavy rains, snow melt, earthquakes, tsunamis, or hurricanes. Likewise, failure of levees and dams or inadequate drainage in urban areas can also result in flooding. Floods are often unpredictable and the aftereffects can be damaging and costly to mitigate.

During floods, underground storage tank (UST) systems can become submerged or displaced by flood waters, leading to damaged UST systems or even releases of regulated substances into the environment. If UST facilities are damaged, they need to be returned to normal operation in the most expedient, safe, and environmentally responsible manner possible.

In the event of a flood, you - the local, state, or tribal underground storage tank authority - may respond to emergency calls from owners, operators, and other affected parties. The U.S. Environmental Protection Agency (EPA) developed this guide to help provide information to localities, states, and tribes when addressing relevant compliance challenges that may arise after a flood. This guide may not cover every possible situation you encounter.

This basic reference guide consolidates published and unpublished information from various federal, state, non-governmental, and UST industry resources. You may use the information in this guide to prepare for, prevent, or lessen the catastrophic effects and environmental harm that could occur as a result of flooded UST systems, as well as help return these UST systems to service as soon as possible.

Note: EPA designed this underground storage tank guide to provide simple guidelines and useful information to state, local, and tribal authorities in the event of a threatened or actual flood. It includes information about preparing for a flood, important actions after the disaster strikes, and information on financial assistance.

Checklists in this guide are not comprehensive and owners and operators may wish to contact other entities for additional information.

This guide does not replace existing federal or state regulations and is not to be used as a regulation. It also does not impose legally binding requirements. The word "should" as used in this guide, is intended solely to recommend or suggest and does not connote a requirement.

For regulatory requirements regarding UST systems, refer to the requirements listed in 40 CFR 280, or the corresponding state regulations.

Effects Of Flooding On Underground Storage Tank Systems

A flood creates an elevated level of risk for environmental damage from UST systems. For example, UST systems may become displaced and release their contents into the environment, causing soil, surface water, and groundwater contamination. While there is little that can be done to prevent flooding, UST owners can take actions to minimize the damage potential that impacted USTs have on human health and the environment when flooding occurs.

The following impacts on UST systems could occur as a result of flooding:

- buoyancy
- erosion and scour
- product displacement
- electrical system damage



UST lifted by buoyant force

Buoyancy

During a flood, an UST system surrounded by floodwaters or saturated soil is subjected to buoyant forces that could offset the restraint of backfill, pavement, or hold-down straps, causing the tank to shift in the backfill from its location. If the UST is unanchored, it may lift out of the ground and float, resulting in a rupture or separation of the connecting pipes, releasing product into the environment.

Erosion And Scour

Forces of rapidly moving water can cause soil erosion (resulting from soil above or around the UST being carried away by wind and floodwaters) and scour (resulting from the velocity of flowing water removing soil cover and supporting backfill material around the UST system). Exposing the system to stressors from flood water pressure or floating debris makes it even more vulnerable to being undermined or collapse. As a result of erosion and scour, underground piping can also shift and become detached from the UST, releasing product into the environment.



Collapsed gasoline tank. Hurricane Katrina – 2005, Biloxi, MS

Product Displacement

During a flood, water or other debris can enter an UST through openings such as fill pipes, vent pipes, gaskets, loose fittings, covers, sumps, and damaged tank walls. As water and debris settle on the bottom of the UST, product will rise and float on top until it exits the tank through openings, releasing product to the environment.

Electrical System Damage



Extended contact with floodwaters may cause damage to electrical equipment associated with UST systems (such as automatic tank gauging systems, panel boxes, emergency shutoff switches, submersible turbine pumps, dispensers, motors, cathodic protection, etc.).

What If An UST Is Located In A Flood Area?

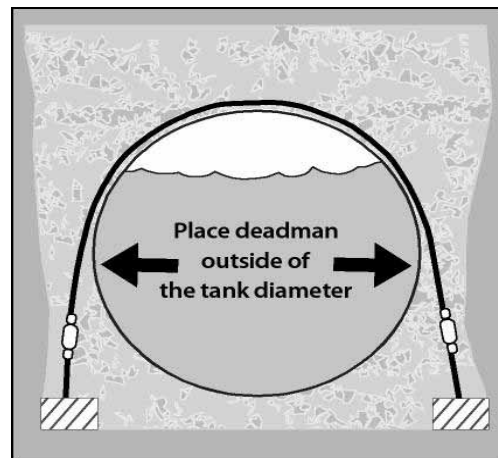
Because of their locations in or near water or low-lying areas, some USTs are particularly vulnerable to the effects of flooding. Installation standards such as the Petroleum Equipment Institute's (PEI) Recommended Practice 100 and the American Petroleum Institute's (API) Recommended Practice 1615 contain information about proper anchoring of USTs.

If there is reason to believe an UST is in a vulnerable location, owners and operators may use the following methods to help prevent USTs from floating during a rise in water levels:

- **Increase the burial depth and/or amount of pavement above the UST.** The extra weight of the backfill and pavement may be enough to keep the tank from floating. The burial depth should not exceed the manufacturer's recommendation.
- **Anchor the UST to counteract the buoyancy force exerted by saturated soil during a flood to prevent flotation by:**

Soil conditions can dramatically affect buoyancy forces. Owners should consult with a knowledgeable professional who is familiar with the local soil conditions when designing anchors to counter buoyancy forces.

- ✓ using deadmen anchors placed outside of the tank diameter along the sides of the UST, with hold-down straps attached.



Deadmen anchors and straps used to offset buoyancy

- ✓ adding additional weight by using a concrete collar.

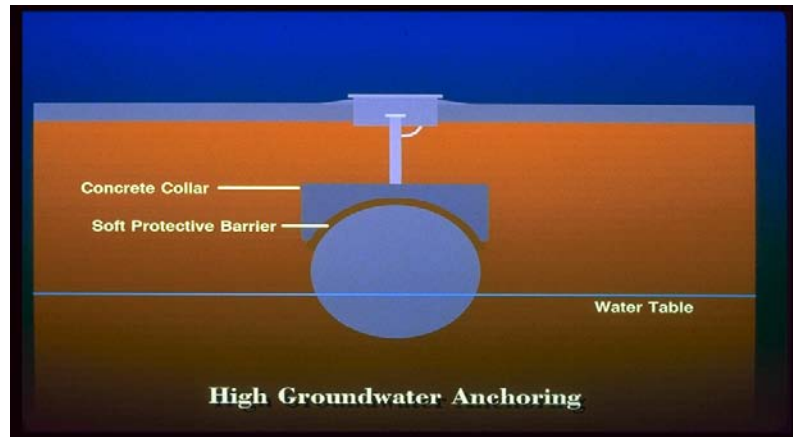


Illustration of adding a concrete collar at the top of the tank to offset buoyancy

- ✓ using hold-down straps to securely attach the tank to a bottom hold-down pad.

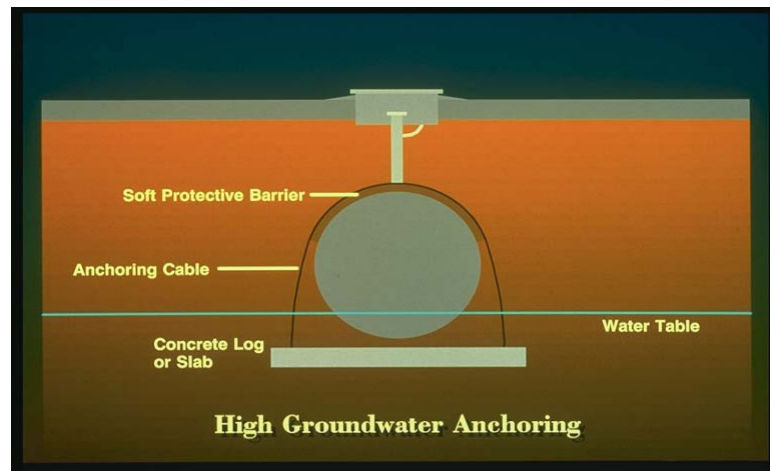


Illustration of hold-down pad installation under the UST to offset buoyancy

Owners and operators may also want to consider taking the following precautionary actions:

- **Equip fuel lines below the flood elevation level with automatic shut-off valves.** This will help prevent loss of fuel in case of line breaks or disconnects from the UST.
- **Add an extension to the vent pipe if it appears the tank may be submerged in deep flood waters.** If water enters the vent pipe, it will settle at the bottom of the tank, pushing product out.

Before A Flood, What Should Owners And Operators Do?

In order to prevent UST system displacement and prevent water from entering the system, owners and operators should consider taking these precautions if there is a threat of flood.

- **Turn off all electricity to the UST system** including power to dispensers, pumps, turbines, automatic tank gauging (ATG) consoles, lighting, and any other system components.
- **Take product inventory and water level reading of all USTs** to help account for possible product loss.
- **Fill the tank** to weigh down the tank so it will not float out of the ground.
- **Secure all openings on top of the tank** and make sure fill caps are in good condition and fastened securely in place and locked. If fill caps are not tightened, tanks will fill with water and release product. Empty or near-empty tanks may float up, destroying overlying concrete/asphalt and distribution lines, which can also release product.
- **Make sure the seal on spill bucket plungers are operational** so water cannot enter the tank.
- **Close the shear valve on pressurized piping** to prevent releases from product dispenser lines.
- **Temporarily cap off the vent pipes** to prevent water from entering the tank and displacing product.
- **Place a dumpster, sand bags, or large containers full of sand or rock over the tank** to reduce the chance of a tank floating out of the ground.

Tank owners and operators should not fill tanks with water because they may incur additional costs for the disposal of contaminated water.

After A Flood, What Should Owners And Operators Do?

After a flood, regional and state UST program representatives may receive calls from UST owners and operators with questions concerning problems with tank systems; or affected parties may call the National Response Center (NRC), the federal government's sole point of contact for reporting all hazardous substance and oil spills. The following practices may help owners and operators quickly and safely restart UST systems and bring them back into service.



*Flood of 1977
Matewan/Tug Valley, West Virginia*

If the UST has been in a flood, depending on the site-specific situation, owners and operators may take the following actions after the water has receded and local officials allow for re-entry:

- **Make sure the power is off** to any UST-related equipment (such as power to the dispensers, pumps, release detection equipment, and other devices).
- **Determine if product** leaked from the UST.
- **Determine if water or debris** entered the UST.
- **After inspecting the electrical system, return power** to the UST system.
- **Check release detection system** for proper operation. Perform release detection again, as soon as possible after the flood.
- **Check all equipment** including pumps, shear valves, fill pipes, and vent lines for proper operation.
- **Clean and empty spill buckets and sumps**, including those under the dispensers and above the tanks. Inspect the piping and fittings for damage and possible leaks.
- **Perform an UST system tightness test** to ensure integrity prior to adding product.
- **Test spill buckets and sumps** to ensure they are tight.
- **Test cathodic protection** to ensure it is operating properly.

For information and checklists about USTs and floods from API, Delaware, Iowa, Louisiana, Minnesota, and Washington, see Appendices A and B.

What If A Tank Floats Out Of Its Excavation?

The tank may float out of its original backfill site if not adequately anchored. If this occurs, the following actions may be appropriate:

- **Notify the appropriate authorities** according to applicable policies, if there is any evidence of spilled product.
- **Notify** the local fire department.
- **Turn off any power in the vicinity of the tanks and piping**, and immediately call the electric company if any power lines are down in the area.
- **Rope off the area and keep people away** from the affected area.
- **Remove all contents** of the tank.
- **Perform initial leak mitigation and release reporting**, if necessary.
- **Obtain a contractor to dismantle any piping and/or dispensers**, and remove the piping and tank properly.

Remind tank owners and operators to follow established state program environmental compliance guidelines for emergency response, cleanup, tank removal, waste disposal, and reinstallation.



Tank floating out of ground, Rockaway River, NJ



Iowa flood of 2008

What If A Remediation System is Flooded?

Some UST facilities have an active soil and/or groundwater remediation system in place that floods can significantly affect. Owners and operators may take the following precautions to minimize damage to the system and safely bring it back into service:

Before a flood –

- **Shut off** power to the remediation system.
- **Disconnect the wiring and piping** to the trailer and remove from the apparent flood hazard area, if there are any portable equipment trailers.
- **Cap and secure** any monitoring, recovery, or injection wells to prevent floodwaters from entering the wells.
- **Remove equipment** from the building and store away from flood waters, if remediation equipment is located in a non-portable building.
- **Close all control valves** to isolate as much of the system as possible.

After a flood –

- **Do not attempt** to restart motors until an electrician checks the motors and/or controls for damage and presence of moisture or silt.
- **Reconnect** the trailer to the power and piping system, if equipment trailer was removed from the site.
- **Return power** to the remediation system after inspecting electrical system. A qualified professional should disinfect components and systems.
- **Remove and discard system** components that are contaminated with flood water and cannot be effectively cleaned and disinfected. Replace them with new components.
- **Clear piping** of water and/or silt that may have collected in the lines, if piping has been damaged or flood water enter the piping.
- **Inspect** monitoring wells for damage.
- **Check the valves** in the piping system for proper operation.
- **Check to see** if water and/or silt entered monitoring/extraction/injection wells.
- **Notify the implementing agency** of any damage that may have occurred.

Other Useful Information

Industry and states developed guides to assist owners and operators in evaluating flood impact and damage to UST systems. Although federal UST regulations do not require using these guides, excerpts from selected guides are available in Appendices A and B.



Note: Leak detection equipment must be operational as soon as practically possible; however, certain leak detection methods may not be viable.

- Use daily inventory control and monthly reconciliation if electronic method of leak detection is not operating. EPA provides guidance books and log sheets for daily inventory control and monthly reconciliation at www.epa.gov/OUST/pubs/doing.htm
- Owners and operators should perform daily checks for water with water-finding paste for several days until the owner determines the system is tight.
- Owners and operators should empty tank contents and stop using the tank if water checks indicate excessive water or daily inventory control shows loss of product.
- Owners and operators should notify the appropriate implementing agency, as soon as possible.

Incident Response

Natural disaster occurrences can damage UST system components, resulting in oil, petroleum, or hazardous substance releases into the environment. You may receive a call requesting information such as: Who do I call? My tank is leaking, what should I do? Is there guidance available for emergency cleanup? Is funding available for cleanups? etc.

What Do I Do If I Get A Phone Call?



Individual owners and operators are primarily responsible for initial response and cleanup and are expected to be the first to handle most problems with existing resources, but in some cases local assistance may be available. If local response capabilities are overwhelmed, state and then regional resources may be used. In Indian country, local and tribal officials are the first responders, and EPA is available for further assistance. The federal government generally only becomes involved when local and state resources are overwhelmed, or when incidents occur in Indian country.

Local, state, tribal, and federal agencies engage in environmental cleanup actions on a regular basis and will be involved in natural disaster response. Local Emergency Planning Committees (LEPCs) plan initial response actions for emergencies within their jurisdiction. They do not perform actual incident response, but attempt to identify potential hazards, find available resources, and write emergency plans. However, they are not available within every locality. For more information or to locate a specific LEPC, see <http://yosemite.epa.gov/oswer/lepcdb.nsf/HomePage>. Owners and operators may also contact a local emergency management office or fire department.

If there is a confirmed release, visible free product, or a substantial threat of a release, tell the caller to contain the leak and notify appropriate local and state authorities. If the release may reach, or has reached, surface water or shoreline, instruct the caller to contact the National Response Center at 800-424-8802 or 202-267-2675 or submit an incident report via email to <http://www.nrc.uscg.mil/nrchp.html>. Also, inform callers to notify the appropriate local or state emergency management authority. If a release is reported, the NRC will notify the appropriate designated federal on-scene coordinator (EPA for inland areas or Coast Guard for coastal areas).

Other Emergency Contacts

- State emergency response or specific state office of emergency management: <http://www.fema.gov/about/contact/statedr.shtml>
- State environmental agency: <http://www.epa.gov/epahome/state.htm>
- EPA regional emergency response management programs: <http://www.epa.gov/OEM/content/regional.htm>
- National Response System (NRS): <http://www.epa.gov/oem/content/nrs/index.htm>

Financial Assistance

- Many states have financial assurance programs and/or disaster trust funds that provide loans and grants to eligible owners and operators for corrective actions and bringing UST facilities back into operation, where applicable. State trust funds may reimburse responsible parties or third parties for corrective actions related to UST releases if certain prerequisites for coverage are met.
- In an emergency, states may use Leaking Underground Storage Tank (LUST) Trust Fund money to conduct emergency responses, site assessments, or corrective actions. In non-emergency situations, states may use LUST Trust Fund money to conduct site assessments or corrective actions where the responsible party is unknown, unwilling, or unable to respond.

UST system owners and operators should contact their financial responsibility or insurance provider to file a notice or claim and determine minimum requirements necessary for continuing coverage. Failure to do so could jeopardize coverage in the event of a subsequent release.

Other Types Of Financial Assistance Available To Owners And Operators

Businesses may obtain financial assistance following disasters, including floods, from the Federal Emergency Management Agency (FEMA) and the U.S. Small Business Administration (SBA).

To qualify for FEMA assistance, the site must be located in one of the Presidential declared disaster counties.

After a Presidential declaration has been made, FEMA will designate the area eligible for assistance and announce the types of assistance available.

FEMA Public Assistance Grant

The objective of FEMA's public assistance (PA) grant program is to provide assistance to state, tribal, and local governments as well as certain types of private nonprofit organizations.

Through the PA program, FEMA provides supplemental federal disaster grant assistance for debris removal; emergency protective measures; and repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private non-profit organizations. The PA program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.

The federal share of assistance is not less than 75 percent of the eligible cost for emergency measures and permanent restoration. The grantee (usually a state) determines how the non-federal share (up to 25 percent) is split with the subgrantees (eligible applicants).

FEMA Disaster Assistance Process

FEMA developed sequential steps owners and operators, as applicants, should follow to obtain prompt disaster assistance. If FEMA assistance is needed:

1- Applicants need to register with FEMA for an identification number. Applicants may register on FEMA's website www.fema.gov/assistance/index.shtm or by phone by calling 800-621-FEMA (3362). Persons with speech or hearing disabilities may call TTY at 800-462-7585.

2- Once a FEMA identification number is secured, applicants may file with SBA by downloading an application from SBA's website <http://www.sba.gov/category/navigation-structure/starting-managing-business/starting-business/forms>, or visiting a SBA local disaster office. For more information, contact SBA Disaster Assistance Customer Service Center at 800-659-2955 or disastercustomerservice@sba.gov or www.sba.gov/services/disasterassistance.

3- Applicants should send the completed application to SBA. Applicants are encouraged to go to a local disaster recovery center (DRC) for assistance completing the SBA application. Some DRC locations will have business recovery centers with staff on the ground to help with paperwork and questions. In addition, applicants may also go to one of the existing small business development centers.

SBA Loans

Through its Office of Disaster Assistance, the SBA provides low-interest loans for damage to businesses that are not fully covered by insurance. After a declared disaster, SBA will deploy loan officers to SBA local disaster offices to provide face-to-face service for disaster victims. Any business that is located in a declared disaster area and has incurred damage during the disaster may apply for a loan to help repair or replace damaged property to its pre-disaster condition.

Physical disaster loans are for permanent rebuilding and replacement of uninsured or underinsured disaster-damaged privately-owned real and/or personal property. SBA's physical disaster loans are available to businesses of all sizes.

Additional State Assistance

During some disasters, states may also request that FEMA assign and fund EPA to provide direct assistance with oil and hazardous materials cleanup. This is accomplished under the Oil and Hazardous Materials Response section (i.e., Emergency Support Function 10 [ESF-10] of the National Response Framework). Facility owners do not request ESF-10 assistance directly from FEMA or EPA. Only a state can request assistance under this mechanism, and FEMA may require a state to contribute a percentage of the ESF-10 costs. For more information on the National Response Framework and ESF-10, see FEMA's web page: <http://www.fema.gov/emergency/nrf/>.

References

EPA compiled many of the recommendations contained in this guide from other federal, state, and industry organizations. Listed below are publications from other organizations that EPA used to prepare this guide. They may be helpful to owners and operators when inspecting, installing, repairing, or replacing UST systems that are impacted by flooding.

- American Petroleum Institute. *Options for Consideration: Opening a Service Station after Flooding*, 2005
- American Petroleum Institute. API Recommended Practice 1615 (1996, 5th ed), Installation of Underground Petroleum Storage Systems
- Canadian Petroleum Products Institute. *Contingency planning for flood related emergencies at retail and wholesale petroleum facilities (2001)*. Retrieved from <http://www.cppi.ca/pdf/FloodProcedures.pdf>
- Delaware Department of Natural Resources and Environmental Control (2006). *Salvageable Flooded Dispensing Facilities with USTs: Recommended Inspection and Integrity Assessment Protocol for Placing Flooded Facilities Back into Service*. Retrieved from <http://www.dnrec.state.de.us/dnrec2000/Divisions/AWM/ust/Download/pdf/Flooded%20USTs.pdf>
- Federal Emergency Management Agency. *Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems (1999)*. Retrieved from <http://www.fema.gov/hazard/flood/pubs/pbuffd.shtm>
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- Iowa Department of Natural Resources (2008). *Floods & Submerged USTs: Procedure to Return Tanks to Service*. Retrieved from <http://www.iowadnr.gov/land/ust/documents/ustflood608.html>
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- Petroleum Equipment Institute. *RP900 Recommended Practices for the Inspection and Maintenance of UST Systems*
- Petroleum Equipment Institute. *RP100 Recommended Practices for Installation of Underground Liquid Storage Systems*
- Petroleum Equipment Institute. *RP500 Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment*
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- U.S. Environmental Protection Agency, Office of Underground Storage Tanks - List of operation and maintenance resources: <http://www.epa.gov/oust/ustsystem/tanko&m.htm>
- U.S. Environmental Protection Agency, Office of Emergency Management – National Response Center. Retrieved from <http://www.epa.gov/oem/content/partners/nrsnrc.htm>
- U.S. Environmental Protection Agency, Office of Emergency Management – Local Emergency Planning Requirements. Retrieved from http://www.epa.gov/oem/content/epcra/epcra_plan.htm
- U.S. Environmental Protection Agency, Office of Emergency Management – Regional Emergency Management Programs. Retrieved from <http://www.epa.gov/OEM/content/regional.htm>
- Washington State Department of Ecology (2009). *Focus on Flooding Prevention*. Retrieved from <http://www.ecy.wa.gov/biblio/0909190.html>

Appendix A – API Checklist

Options for Consideration: Opening a Service Station after Flooding

This list is not intended to be a complete checklist. In general, after severe flooding, serious consideration should be given to having a system test similar to a test done for a new installation completed by a competent technician. All suggestions may not necessarily be applicable to every station or situation and therefore may not be required.

DOs:

UST

- Check electrical system for continuity and shorts (pumps, turbines, dispensers, emergency shutoff, panel box, etc.)
- Check Critical safety devices (e.g., shear valves, stop switches, isolation relays on dispensers, etc.)
- Check tank bottoms for water and debris (due to surface infiltration) *
- Check tightness testing of tanks
- Check deflection of fiberglass tanks. If deflection is greater than manufacturer's specification (general guideline is 2%), call the manufacturer for instruction
- Check cathodic protection system to ensure it is connected and operational
- Flush dispensers and entire UST system with nitrogen (or some other inert gas)
- If tanks shifted and problems are found, repair them according to appropriate industry standards (API 1615 and NFPA 30 and 30A) and regulations (40 CFR 280)
- Follow proper procedures for calibrating tank inventory charts (SIR tank angle)

Dispenser/Lines

- Check vents for blockage and proper operation
- Eliminate water in dispenser sumps, pans, tank sumps, etc. (Sump water should be removed by an authorized and/or state licensed waste hauler to be taken to an appropriate treatment facility.)
- Check vent and vapor lines (Stage II) for movement and cracking
- Check all Stage II system equipment (e.g., filters, screens, etc., for the presence of dirt, mud, etc.)
- Check dispenser filters and submersible check-valve screens for plugging with dirt or mud
- Check tightness testing of piping

Monitoring Equipment

- Check pressure transducers on product line leak detectors (ensure no water infiltration)
- Check monitoring wells for contamination
- Check with vendors for recommendations on proving equipment
- Ensure that communication system working related to any remote monitoring (GVR and the FMS)
- Ensure security systems are in place (cameras and alarm functions)

Miscellaneous

- Treat and dispose of any hazardous waste (i.e., gasoline contaminated water or water contaminated gasoline) according to applicable federal (i.e., Resource Conservation and Recovery Act and its attendant regulations) and state laws and regulations
- Ensure payment process is functioning
- Ensure adequate lighting on forecourt
- Clear all stormwater drains of debris
- Notify authorities as appropriate

DON'Ts:

- DO NOT receive new product until system integrity is proven
- DO NOT assume everything is okay because water didn't actually flood over station. The water table could have risen and caused problems

* Stick tank or read automatic tank gauge system to determine whether water has entered the UST. If using ethanol as an oxygenate in your fuels, determine whether ETOH phase-shift has occurred (use an ethanol-water detecting paste). If water is in the tank and ethanol is not an oxygenate, have the water pumped from your UST by a licensed and approved waste hauler to be taken to an appropriate treatment facility. If ethanol is used as an oxygenate and a phase-shift has occurred, which could happen with 5-6 inches of water) consider pumping the UST completely. Again have the water pumped from your UST by a licensed and approved waste hauler to be taken to an appropriate treatment facility.

Appendix B – Selected State Information On Returning Flood Impacted USTs To Service

Delaware Department of Natural Resources recommended guidance on UST inspection and assessment after a flood



Department of Natural Resources
and Environmental Control
Tank Management Branch
391 Lukens Drive
New Castle, DE 19720
(302) 395-2500 (phone)
(302) 395-2555 (fax)

Salvageable Flooded Dispensing Facilities with USTs: Recommended Inspection and Integrity Assessment Protocol for Placing Flooded Facilities Back into Service

- 1 Render the facility in a safe condition by turning off all power.
- 2 Inspect for obvious damage to the dispensing facility. Cover pad movement is an indicator of possible tank movement. If there is an indication of cover pad movement, especially if the cover pad is needed to prevent floatation, remove cover pad, inspect tank and replace if tank is O.K.
- 3 Any evidence of tank, vent or line movement (horizontal or vertical) will necessitate replacement of affected components. If the tank manufacturer will recertify the tank after removal, it may be reinstalled.
- 4 Tanks and all lines need to be checked for water contamination and drained or pumped dry, cleaned and sanitized where necessary.
- 5 Interstitial spaces of tanks and lines need to be drained, flushed and sanitized where possible. Blockage of interstitial spaces will render leak detection useless. Depending on the level of residual contamination at the facility, certain leak detection methods may no longer be viable. Be prepared to update leak detection equipment.
- 6 Salvageable dispensers shall be flushed clean and all filters etc. replaced.
- 7 Submerged dispensers will have to be replaced. This includes the hanging hardware.
- 8 All facility sumps and spill buckets need to be pumped dry, cleaned and sanitized. Replace sump lid gaskets if applicable. If sump lids are missing, replace with new water tight lids. Test for tightness and replace sumps and spill buckets that fail tightness testing.
- 9 Shear valves and related safety equipment may be salvaged if they can be cleaned and lubricated with corrosion preventative. Some will still have to be replaced.
- 10 Sump sensors submerged for a prolonged period of time will need to be replaced.

- 11 In-tank pumps, ATG probes, overfill devices, automatic line leak detectors, fill and vapor dust caps etc. are probably O.K. Assess their condition after cleaning and replace as necessary.
- 12 Non water-tight conduits will be a problem. Drain and sanitize wherever possible. Check wiring for shorts. Consider sealing conduits where possible.
- 13 Submerged ATG consoles and any associated electronics will need to be replaced. If not submersed, have certified technician perform a programming and operability check.
- 14 Submerged CP rectifiers and associated aboveground equipment protecting tanks and/or lines will have to be replaced. If not submersed, have a NACE certified professional perform an operability check of equipment. Inspect CP lines in saw cuts for damage and replace as necessary. If CP systems are out of service for an extended period of time, perform integrity assessment of affected component before placing CP system back into service. A NACE certified professional will be helpful in assessing the CP system.
- 15 Check accessible fittings, valves and miscellaneous piping for damage and corrosion. Clean and replace as necessary.
- 16 Pressure test tanks, lines and interstitial spaces. Assess interstitial spaces for blockages, especially if used for leak detection.
- 17 Perform blockage tests on all lines prior to start up.
- 18 To assess tightness of vapor spaces, perform pressure decay test of the system.
- 19 Document all inspection, repair and assessment activities at each flooded facility in accordance with Tank Management Branch requirements.
- 20 Check with the Tank Management Branch to verify what Financial Responsibility items that need to be addressed prior to placing the facility back into service.

Excerpt from Iowa Department of Natural Resources guidance for UST system evaluation

Before flooded UST systems are returned to operation, they must be evaluated by an Iowa licensed installer, installation inspector or compliance inspector to determine the extent of damage or whether they are suitable to receive product. The owner or operator must document to the DNR that the system has been inspected and certified as safe to return to operation. A list of Iowa licensed installers can be found at DNR's UST Section website: <http://www.iowadnr.com/land/ust/ustinstall.html>.

The evaluation of UST status should begin as soon as conditions and officials allow flood area re-entry. This policy assumes that there is a reasonable likelihood that a release of product may have occurred if an UST system has been submerged or affected by flood waters. The following procedure is intended to, in part, comply with the "system check" requirements whenever there is a suspected release as provided in agency rule 567 Iowa Administrative Code 135.6. This policy further assumes that damage may have occurred such that inspection, product removal and repairs may need to be undertaken. All submerged and flood affected USTs must follow the proceeding evaluation before start up.

1. Measure for water in the tank bottoms with your ATG system or by using a gauge stick (capable of measuring the level of product to within 1/8 inch) and water finding paste. If you have over an inch of water you will need to remove it. No water is acceptable for tanks containing an ethanol blend as the water will be absorbed by the ethanol and create fuel quality problems. Contact a hazardous waste management company (see last page for a list) for more information about removing water/ethanol mix from ethanol blended tanks. Fuels sold in retail markets must meet strict ASTM standards; make sure your fuel quality is not compromised. Fine silts are present in flood waters and may contaminate the fuel. The fine silts will need to be removed if present. Fuels will have to be removed if the UST system is found to be damaged during the evaluation.
2. Before returning to operation, all flooded UST systems must conduct tank and line tightness testing (0.1 gph). Tightness testing may be conducted using an Automatic Tank Gauging (ATG) system or a third party tightness tester. Tanks with secondary containment (double wall) may use interstitial monitoring in lieu of tightness testing. Tanks with confirmed "Fail" results must be emptied.
3. If water entered interstitial spaces of tanks and product lines, they must be drained and flushed where possible. Tanks with brine, vacuum or interstitial sensors may be returned to service if the levels are normal.
4. Empty and clean all containment sumps, spill buckets and dispenser pans. If there is no petroleum sheen on the water, you should be able to empty it onto the concrete where it can evaporate. Water with a petroleum sheen or floating product in a containment sump must be investigated for a release. The water and petroleum must be removed and properly disposed by a hazardous waste management company (a list is provided with this guidance memo). Do not discharge contaminated water to a streets, storm sewers, ditches or sumps. Do not operate pumps and dispensers if they continue to fill with flood waters as there is chance water could enter the fueling system and damage components.
5. Submerged dispensers may have to be replaced or repaired if possible. Any submerged suction system will have damaged motors and pumps. Check hanging hardware for damage.
6. Check sump lid gaskets. After initial cleaning and drying make sure sumps, dispenser pans and spill buckets are liquid tight and prevent water ingress.
7. If you have more than one inch of water in a diesel or gasoline tank (non-ethanol blend), have it removed by a hazardous waste management company. More than an inch of water at the bottom of the tank can contaminate fuel systems in vehicles. Hazardous waste management companies can remove the water and leave the product in the tank.
8. Check the deflection of fiberglass tanks to make sure they meet the manufacturer's specification.

9. Determine whether the tank moved or shifted. If problems are found, repair according to manufacturer's instructions and appropriate industry standards and regulations. These tanks must not receive fuel until that are deemed safe and tight.
10. Check vents for movement, cracking, blockage and proper operation. This is a common area for water ingress and damage from flooding.
11. Check dispenser filters and submersible check-valve screens for plugging with dirt or mud.
12. Check critical safety devices (e.g., emergency power off controls, line leak detectors, air compressor pressure limiters, shear valves, stop switches, isolation relays on dispensers, etc.). Shear valves may be salvaged if they can be cleaned and lubricated with corrosion preventative. Some may still have to be replaced.
13. Sump sensors may need to be replaced after emergency conditions cease.
14. Submersible turbine pumps, ATG probes, overfill devices, ALLDs and all caps at the top of the tanks must be assessed for damage and replaced if necessary.
15. After flooding has abated, submerged CP systems must be assessed by a NACE or Steel Tank Institute certified cathodic protection professional. Submerged rectifiers may have to be replaced, if not submerged they must be checked for proper operation. Inspect CP wiring in saw cuts for damage and replacement if necessary.
16. Make sure the electrical system for the ATG, fueling and corrosion prevention systems is checked for shorts and continuity before restoring power.
17. All electrical junction boxes and conduit should be inspected for the presence of water and dried or vacuumed and for the presence of electrical shorts or opens. Open all dispenser panels to inspect and dry out.
18. Make sure tank management tags are present on the fill port. If missing contact the numbers listed in this guidance.

The following steps should be taken after your UST system is evaluated as safe and operational:

1. Check daily for the presence of water (with water finding paste) to ensure the system is tight. If these water checks indicate excessive water or you are showing loss of product on daily inventory, the tanks should be emptied of product and use of the tanks should discontinue. Such a condition must be reported to DNR (515.281.8879 or 515.281.8779) no later than 24 hours after discovery. See rule 567 IAC 135.6 .
2. Use daily inventory control and monthly reconciliation if your current electronic method of leak detection is not operating. Guidance books and log sheets for daily inventory control and monthly reconciliation are provided on EPA's website: <http://www.epa.gov/OUST/pubs/doing.htm>.

GENERAL INFORMATION

UST Owners/Operators will be responsible for evaluating underground storage tank systems to determine if they are suitable for receiving product. Flooded systems that are **determined to be suitable for receiving product** may be put back into service and should have an integrity test performed as soon as contractors and services become available to perform the testing and no later than six months after product was first placed into the tank after flooding. If the tank inspection outlined below (or subsequent monitoring of the tank), indicates that the system has been comprised; **the system should be taken out of service** and repaired or replaced as necessary and an integrity test performed prior to again putting the system into operation.

General Evaluation Protocol for Contractors

No equipment should be turned on prior to examination. Check all electrical panels and make sure they are clean and dry. All equipment related to electric power service should be inspected and any necessary repairs should be made prior to power restoration. This includes all fueling systems, leak-detection devices and corrosion prevention (impressed current) equipment. The electrical system should be checked for continuity and shorts (pumps, turbines, dispensers, ATG consoles, emergency shutoff, panel box, etc.)

Specifically, all electrical junction boxes and dispenser heads should be opened, inspected and dried if necessary. Conduits should be inspected for the presence of water, insulation damage, shorts or opens. Conduits exhibiting water should be dried or vacuumed as appropriate and all defective wiring should be replaced. To apply electrical power to a UST system before conducting basic examination could be extremely dangerous.

Submerged pumps and dispensers should not be operated if there is the possibility of water entering into the system as pumping water may damage hydraulic components.

Technical Protocol for Contractors

These protocols should be followed to place tanks back into service:

1. Stick tanks using water finding paste or read automatic tank gauge system, if operable, to determine whether water has entered the UST.
2. Flooded or water impacted tanks and all lines may need to be drained of water and dirt/mud or perhaps pumped dry and cleaned as conditions warrant. Liquids removed must be properly handled and disposed.
3. Interstitial spaces of tanks and lines of double walled systems, if flood-impacted, will need to be drained and flushed where possible. Blockage of interstitial spaces will render leak detection useless. Depending on the level of residual contamination at the facility, certain leak detection methods may no longer be viable. Tanks with brine or vacuum interstitial sensors may be returned to service if brine or vacuum levels are normal. Be prepared to update damaged leak detection equipment after emergency conditions are abated.

4. All facility sumps, pans, and spill buckets need to be pumped dry and cleaned. Replace sump lid gaskets if applicable. If sump lids are missing, replace with new water tight lids. Replace sumps and spill buckets that fail to prevent water intrusion after initial cleaning and drying.
5. Check tank bottoms for water and debris. Remove and dispose as appropriate (see item #2 above).
6. Check deflection of fiberglass tanks. If deflection is greater than manufacturer's specification (general guideline is 2%) call the manufacturer for instruction.
7. If tanks shifted and problems are found, **repair or replace them** according to manufacturer's instructions and appropriate industry standards and regulations. Obviously, these **systems should be shut down and not receive fuel** until they are deemed safe for reuse (tightness tested).
8. Check vents for movement, cracking, blockage and proper operation.
9. Check dispenser filters and submersible check-valve screens for plugging with dirt or mud.
10. Flush dispensers and UST system if necessary. Collect fluids for proper disposal.
11. Check critical safety devices (e.g., emergency power off controls, line leak detectors, air compressor pressure limiters, shear valves, stop switches, isolation relays on dispensers, etc.) Shear valves may be salvaged if they can be cleaned and lubricated with corrosion preventative. Some will still have to be replaced.
12. Sump sensors may need to be replaced after emergency conditions cease.
13. In-tank pumps, Automatic Tank Gauge (ATG) probes, overfill devices, automatic line leak detectors, fill and vapor dust caps, etc. should be assessed. Assess their condition after cleaning and replace as necessary.
14. ATG consoles and any associated electronics that are not submerged, should have a programming and operability check performed by a certified technician after emergency conditions cease.
15. After emergency conditions are abated, submerged Corrosion Protection (CP) rectifiers and associated aboveground equipment protecting tanks and/or lines may have to be replaced. If not submerged have a National Association of Corrosion Engineers (NACE) certified professional perform an operability check of the equipment. Inspect CP lines in saw cuts for damage and replace as necessary. If CP systems are out of service for an extended period of time perform integrity assessment of affected component before placing CP system back into service. A NACE certified professional will be helpful assessing the CP system.
16. Check accessible fittings, valves and miscellaneous piping for damage and corrosion. Clean and replace as necessary.
17. Document all inspection, assessment and repair activities at each UST system site. Provide this information to the LDEQ in stand-alone report format within 90 days of initiation of operations of that UST facility.
18. Submerged dispensers will have to be replaced or repaired as necessary. This includes the hanging hardware. Any suction system dispensers will probably have flood impacted motors and pumps and may need complete replacement.

General Protocol Upon Resumption of Service:

Depending on the level of residual contamination at the facility, certain leak detection methods may no longer be viable. Daily inventory control (with strict record keeping) may be the short-term leak detection method by necessity. Daily checks for water with water-finding paste should be done for several days until it has been determined that the system is tight. If these daily water checks indicate excessive water or the daily inventory control shows loss of product, **the tanks should be emptied of product and use of the tanks should cease**. Notification of these conditions should be made to the LDEQ UST hotline (225) 219-3406) as soon as practical.

Post Start-Up Protocol for Contractors

This protocol should be followed once flood-impacted tanks have been placed back into service and emergency response and restoration have been completed or as otherwise directed by LDEQ:

Precision tightness test tanks, lines and interstitial spaces (after emergency conditions abate). Assess interstitial spaces for blockages, especially if used for leak detection. Decisions regarding replacement of tanks and lines should be made based on outcome of these tests. LDEQ field staff should be consulted on these decisions whenever possible. Cathodic protection systems should be checked to make sure they are connected and operational.

These actions are being delayed in an effort to expedite fuel delivery capabilities and due to unavailability of sufficient contractors to perform the otherwise required work in a timely manner. All leak detection equipment must be put back into operation as soon as practically possible or as directed by the LDEQ after the emergency has abated.

Other General Provisions for Owner/Operators and Contractors:

At flood-impacted sites, facilities will be allowed to salvage useable fuel in USTs by checking fuel for water and allow salvage of useable fuel. If flood water covered vent lines, displacement of fuel would have occurred and large volumes of water may exist in the affected USTs and require proper storage/disposal. This water should not be discharged to areas such as streets, storm drains, sumps and ditches that are not permitted to receive these liquids.

Requirements for remediation of contaminated groundwater via approved corrective action plans in place prior to the Hurricane are suspended at UST sites in the parishes of Jefferson, Orleans, Plaquemines and St. Bernard unless otherwise directed by the LDEQ. However, LDEQ may require systems remediating free phased product to continue pumping operations.

Sites which have not experienced impacts from the Hurricane shall continue with routine remedial efforts and reporting (Unless RAC/consulting firm handling the remediation has been affected and displaced by the storm).

All facilities in which remedial efforts are temporarily suspended or delayed must provide notice to the LDEQ UST hotline (225) 219-3406 and provide written documentation as directed.

EVALUATION SCHEDULE

The evaluation of UST status should be initiated as soon as conditions allow flood area re-entry. Further testing will be performed once emergency conditions and major restoration efforts are complete and when sufficient contractors are available to perform the work. This further testing should be performed no later than six months after product was first placed into the tank after flooding.



Preparing Your Underground Storage Tank for a Flood

Tanks/Underground/Storage Tanks #1.16 • August 2006

What to do if flooding threatens an underground storage tank

If you have not properly anchored your tank and if floodwaters or rising ground water threaten your underground storage tank (UST) system, follow these steps to keep the tank in the ground and prevent water from entering the system:



Figure 1. Tanks are typically buried 3 to 4 feet below finished grade to provide adequate slope for piping and protection from traffic loads. Except in areas with high water tables or areas subject to flooding, the weight of the backfill and pavement over the tank is sufficient to offset buoyance and prevent flotation.

- Keep the tank full of product. This will add weight to the tank so it will not float out of the ground. Do not fill the tank with water; if you do, you will have to properly dispose of the water later, and disposal of contaminated water can be very expensive.
- **Secure all the openings on top of the tank.** Make sure the fill caps are in good condition and fastened securely in place. Also, check the seal on the plungers in the spill buckets so water cannot get into the tank.
- Pressurized piping systems have shear valves. Close or “trip” the shear valve. This will prevent product from getting out of the pipelines if debris floats by and knocks over a dispenser.
- **Secure all the openings on top of the tank.** Make sure the fill caps are in good condition and fastened securely in place. Also, check the seal on the plungers in the spill buckets so water cannot get into the tank.
- Turn off the electricity to the UST system. This includes power to the dispensers, pumps, lighting and any other system components.

t-u1-16

Minnesota Pollution Control Agency • 520 Lafayette Rd. N., St. Paul, MN 55155-4194 • www.pca.state.mn.us
651-296-6300 • 800-657-3864 • TTY 651-282-5332 or 800-657-3864 • Available in alternative formats

What to do if a tank floats out of its excavation

If your tank was not anchored when it was installed, it may float out of its excavation. If so, follow these steps:

- If there is any evidence of spilled product, call the Minnesota Duty Officer at 800-422-0798 or 651-649-5451. The Duty Officer will inform Minnesota Pollution Control Agency (MPCA) Emergency Response of the spill.
- Call your local fire department.
- Turn off any power in the vicinity of the tank(s) and piping. If any power lines are down in the area around the tank(s), call the power company immediately.
- Rope off the area and keep people away from the hole in the ground.
- If you tank has not floated away, empty it of all product.
- Call a certified tank removal contractor to remove the piping and tank properly.
- Call the MPCA's Tank Compliance and Enforcement Unit at 651-296-6300 or 1-800-657-3864 for information about tank removal, reinstallation or replacement, or potential assistance.

What to do if the system is submerged by floodwater or subject to abnormally high ground water

In some instances, tanks pop right out of the ground, but in other instances, the tank and piping system may shift in the ground, threatening the integrity of the storage system. If your UST system becomes submerged by floodwater or if it is subject to abnormally high ground water, follow these steps when the floodwater or ground water has receded:

- Turn off the power (electricity) to any UST related equipment before beginning any investigation. This includes the power to the dispensers, pumps, release detection equipment, and other devices.
- Remove water from the sump(s) under the dispensers and above the tanks. Sumps at USTs are commonly located around the fill pipe and the submersible pump. Inspect the piping and fittings for damage and possible leaks.

- Test the leak detection system on your tanks and piping. If no leak detection system has been installed, run tightness tests to ensure the integrity of the entire system.
- Use water finding paste on the end of your gauge stick to determine whether water has entered the tank. If it has not, the UST system is probably intact and further investigation is not needed. Continue to keep good inventory records so that product loss will be easy to identify should a leak occur; good records are essential whether you have a flood or not.
- If there is water in the tank, try to determine its source. Water may have entered through a loose fitting on top of the tank or the UST may have shifted in the ground, damaging the tank, piping or both. Testing of the piping and tank is required if you are unable to determine how water entered the system.
- If the tank has a cathodic protection system, test it to make sure it is still operating properly.

What can be done during tank installation that would help if there's a flood or high water table

There are three main methods of restraint that will prevent a tank from floating because of flooding or a high water table:

- Increase the burial depth and/or amount of pavement above the tank. The extra weight of the backfill and pavement is often enough to keep the tank from floating. Note that the maximum burial depth for fiberglass tanks is seven feet. The burial depth should not exceed the manufacturer's recommendation.
- Use a **hold-down pad**. This is a cement pad placed underneath the tank. (See Figure 2.)
- Use **deadman anchors**. Deadman anchors are beams of reinforced concrete that are placed along the sides of a tank. Extending straps are placed over the tank and attached to the anchors. (See Figure 3.)

Focus on Flooding Prevention



Toxics Cleanup Program

August 2009

Flood Prevention for Underground Storage Fuel Tanks in the Green River Valley

If you have an underground fuel storage tank and you live below the Howard Hanson Dam in the Green River Valley, your tank system may be at higher risk for damage during the coming flood season (roughly October through March).

The King County Flood Control District has warned residents, businesses and farms below the Howard Hanson Dam to prepare now for a higher risk of flooding.

The higher risk is due to water seeping more rapidly through the earthen bank next to the dam after record high water last winter. Until the U.S. Army Corps of Engineers (Corps) can make repairs, it will limit the amount of flood water it stores behind the dam, according to the district's August 10th, 2009, bulletin.

The restricted flood storage means if heavy and prolonged rain occurs this flood season, many homes, businesses and agricultural lands in the valley that don't typically flood could be flooded by several feet of water. This includes parts of Auburn, Kent, Renton, South Seattle and Tukwila according to the district bulletin.

If flooding should occur, your underground fuel storage tank system may be affected or damaged by flooding in several ways:

- Empty or very low fuel could cause certain tanks to float out of the ground.
- Loose fittings above the tanks could cause water to enter the tanks and displace the fuel out of the tanks.
- Groundwater pressure can put stress on underground piping possibly causing it to shift and crack.
- Water and debris can damage electrical systems.

There are several possible steps you can take **in advance to limit the damage to your underground tank and the environment** if flooding occurs.

- **Keep the tank one-third to two-thirds full of fuel.** This will add weight to the tank so it is less likely to float out of the ground. Do not fill the tank full; at least one-third of the tank should be empty to allow for potential flood water that may

Contact information

For reporting a spill or tank failure:

**Ecology's Spills
Reporting Hotline
1-800-258-5990**

If you have questions about your underground fuel storage system:

**Northwest Region
(425) 649-7000
Southwest Region
(360) 407-6300**

**Department of Agriculture
(360) 902-1857**

Ecology UST Web page:

<http://www.ecy.wa.gov/programs/tcp/ust-lust/tanks.html>

Links for flooding publications on web page
<http://www.ecy.wa.gov/programs/tcp/ust-lust/tanks.html>

Finding an UST service provider:

http://www.ecy.wa.gov/programs/tcp/ust-lust/svc_pro/svc_prov_disc_laimer.html

King County Web Page on Flooding:

<http://www.kingcounty.gov/safety/FloodPlan/GreenRiverValley.aspx>

Publication Number: 09-09-190

Please reuse and recycle

enter the tank through fittings; this will lessen the likelihood of fuel being released into the floodwater.

- **Secure all the openings on top of the tank.** Make sure the fill caps are in good condition and fastened securely. Also, check the seal on the plungers in the spill buckets so water cannot get into the tank. Have your tank service provider ensure all riser fittings above your tank are tight, including the following risers: vapor recovery, Automatic Tank Gauge probe, interstitial port, and empty risers.

If you need to **evacuate the site due to imminent flooding** please take the following steps:

- **Close or “trip” the shear valve on your pressurized piping system** to prevent fuel from getting out of the pipelines if debris floats by and knocks over a dispenser.
- Start a log book with the **level of fuel and water in each tank** or print out the level from the automatic tank gauge system if you have one.
- **Turn off the electricity to the system.** This includes power to the dispensers, pumps, lighting and any other system components.

Procedures to follow for a spill from your underground storage tank:

- If there is any evidence of spilled fuel, call the Ecology’s Spills Reporting Hotline (*see other side of this publication for contact information*).
- Call your local fire department.
- Turn off any power in the vicinity of the tank(s) and piping. If any power lines are down in the area around the tank(s), call the power company immediately.
- If your tank has floated out of the ground, rope off the area and keep people away from the hole in the ground.

After the flood recedes do not use the tanks until you have completed the following steps:

- **Check your tank for water**, using a stick and water-finding paste. If there is water, have it removed. Even though you do not see water on the pavement, the flood waters may still be underground above the tank where you cannot see it. Have a tank service provider remove water from your spill buckets and all sumps above the tanks and under the dispensers.
- **Stick the tanks every 2 hours** and keep a log book with the level of fuel and level of water. Check your first reading against the fuel level before the flood. Determine if you have lost any fuel out of the tank. If the amount of fuel in your tank is decreasing, it **must immediately be removed** by a reclaimer or recycler. If water continues to accumulate, have it removed. When no water has entered the tank for a full 24 hours, you may proceed to the tank and line tightness testing.
- **Tank and line tightness testing** must be performed by a certified tank service provider to ensure the system is tight and not damaged. The tank service provider must also verify the condition of your system and determine if the underground storage tank system meets requirements. If you fail the tank tightness test, the remaining fuel **must be removed** by a reclaimer or recycler.

If your underground storage tank system passes the tightness testing and is in compliance with the tank regulations, the next steps are:

- If your tank took on water, the **remaining fuel must be tested** to ensure it meets fuel quality specifications. Please call the Department of Agriculture, for more information.

- If your tank contains E10 gasoline or alcohol-blended fuels, the **remaining fuel must be tested** to ensure it meets fuel quality specifications; even if your water-finding paste did not detect water. Alcohol-blended fuels can contain entrained water above the allowable limits, which the **water-finding paste may not pick up**. Please call the Department of Agriculture for more information.
- If the fuel does not meet fuel quality specifications it **must be removed** by a reclaimer or recycler.

See two additional Ecology publications: *Flooding: Evaluating your Underground Storage Tank System Before Restart* and *Instructions for Service Providers – Underground Storage Tank System Restart After Flooding* (links are on the Ecology's UST web page; see the first page of this publication for information).

Special accommodations:

To ask about the availability of this document in a version for the visually impaired call the Toxic Cleanup Program at 360-407-7170. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.

