

NC Dept of Environmental Quality, UST Section

Aboveground Storage Tanks

Storm Preparation & Recovery Best Practices

Research into the spills caused by major hurricanes, found that aboveground storage tanks failed due to one of three reasons. These were: 1) exposure to storm surge, 2) exposure to flooding, or 3) impact from debris. Tank failure took the form of flood induced displacement (floating), shell buckling or rupturing of the tank.



1) **Storm Surge.** This abnormal rise of the sea is created as water pushes towards land due to an incoming hurricane or tropical storm. A storm surge's severity is affected by the shallowness of a water body and the timing of the tides. A storm surge can penetrate well inland from the coastline.

2) **Flooding.** While flooding may occur at any time, heavy rainfall ahead of a hurricane or tropical storm can cause problems well inland. As heavy rain accumulates, an area's ability to shed water diminishes and flood threats can quickly build. Flooding can also be caused by rapidly melting snow, backed-up storm drains, compromised levees or saturated ground due to extended periods of rain.



3) **Debris.** Storm generated debris is a common hazard and difficult to safeguard against as it can be brought onto the facility by the storm or be created by gear and other miscellaneous items already there. The greatest debris threat comes from when a tank has begun to float (becoming "debris") and threatens to damage other tanks. This specific threat underscores the need to prevent a tank from floating in the first place.

In those instances where an aboveground storage tank successfully survived exposure to these three hazards, the following was discovered:

- The tank had a greater height of product inside than the floodwaters outside and/or;
- The tank had been securely anchored to its foundation

Best Practices

As a general rule of thumb, to avoid floating and reduce the chances of a tank buckling or rupturing, the height of the product inside should be at least equivalent to, but preferably greater than, the height of the water level outside. The exact amount needed to prevent floating, buckling or rupturing will vary depending on the product's density. For example, a tank of gasoline would require higher content volume than a tank of asphalt due to gasoline's lower density.

_____ Prior to the storm, empty tank of product and fill entirely with water

_____ If removing the product is not possible, add more product to the tank so its height is 3-6 feet higher than the expected storm surge or predicted reach of flood water. Close valves associated with piping and dispensing

_____ Anchor tanks and all piping to prevent uplift or floatation

_____ Use stiffener rings to prevent buckling from storm surge and wind loads

_____ To the greatest extent possible, remove or secure all possible projectile hazards from the facility grounds

_____ Ensure all storm drains and dewatering intakes are clear and free of debris.

_____ Shut off the power to the fuel system

_____ Inventory and record the level of product in each tank to account for any loss or water entry

_____ Conduct a detailed risk assessment of the facility and evaluate the impact of mitigation strategies; include these assessments in the Spill Prevention, Control and Countermeasure Plan, Facility Response Plan, Risk Management Plan or other pollution prevention plan, as applicable. Develop a detailed timeline for preparing tanks in advance of an event

Additional steps to consider:

_____ Move product out of the flood location; sell product from those stock tanks which are accessible by truck

_____ Seal thief hatches with locks and sand-bags

_____ Modify vent lines on the tanks by placing a check valve at the exit point so flow can only go inward

_____ Stay in contact with responsible authorities such as the US Army Corps of Engineers, US Coast Guard, EPA, state and local agencies and monitor water levels closely

_____ **Alert the local and state departments if there has been a release or discharge**

_____ Facility personnel will need to know the hazards involved; this may require an assessment to identify spilled or released substances. Sampling, monitoring, as well as personal protective equipment may also be required (for more information, see OSHA's Hurricane eMatrix)

Cylinders, Drums, and other Tanks and Containers:

Steps should also be taken to safeguard compressed gas cylinders, containers and other storage tanks during a storm or flooding event. Cylinders and tanks holding gases or toxic chemicals such as propane, anhydrous ammonia, bulk liquid fertilizer and pesticides can become a serious hazard if damaged. Risks include the release of flammable or toxic gas into the atmosphere, fire, or explosion. To reduce these risks, follow these best practices before and after a flood event.

Best Practices: Before the event

- _____ Move small portable tanks to higher ground, ensure valves are tightened. Do not leave tanks in unventilated sheds or buildings
- _____ Palletize individual compressed gas cylinders together using straps, chains or rope and move to higher ground
- _____ Larger storage tanks on wheels should be disconnected and also moved to higher ground with all valves tightened, locked and secured
- _____ If moving a larger storage tank to higher ground is not possible, secure the tank to an immovable object
- _____ Lash storage containers together, then anchor and secure in the same manner as a large storage tank
- _____ To prevent underground tanks from being hydrostatically lifted, fill completely with either product or water. Secure all openings to the tops of the tanks, ensuring that the fill cap, vapor recovery cap, and tank probe are all sealed or capped. Shut off the power to the fuel system
- _____ Close the shear valves below the dispensers on each underground tank's pressurized piping system. Inventory and record the level of product in each underground tank to account for any loss or water entry
- _____ Any tanks left online for last minute use should be secured and the supply valve shut off prior to the arrival of the storm or flood waters
- _____ Be sure to avoid securing tanks, cylinders, or containers to power or telephone poles
- _____ Inventory all stored products and have this available for response personnel post-event
- _____ Accelerate or postpone any product shipments as the timeline of the event demands
- _____ Ensure the facility name, contact phone number and contents are prominently displayed on all tanks, cylinders and containers

Best Practices: After the event

- _____ Carefully check all tanks, cylinders and containers for damage or leaks
- _____ Look specifically for dents, torn or disconnected supply lines, broken valves, or evidence that its condition is compromised in any way
- _____ Conduct a post-event inventory; report any discrepancies
- _____ Use certified inspectors, as required, to inspect tanks and equipment before reconnection and use
- _____ Separate and make safe all water-reactive chemical products and flammable liquids. In case of spillage, they would create a pollution issue and a fire hazard with potentially catastrophic consequences
- _____ If possible, make sure that vents from tanks and containers are extended above the maximum anticipated flood level
- _____ **Alert the local and state departments if there has been a release or discharge**

After the storm, contact local emergency organizations as needed (e.g., fire department, emergency management) and those companies able to provide services and equipment for cleanup, salvage or alternative production. If the entire region was subjected to flooding, such services will be in heavy demand. Once cleanup operations are completed, a more in-depth assessment of flood damage to equipment will be necessary.

For spills in coastal waters and deepwater ports - US Coast Guard: 757.398.6231

For spills impacting land call North Carolina Department of Environmental Quality UST Section

National Response Center:	800.424.8802
Asheville, NC Regional Office:	828.296.4500
Fayetteville, NC Regional Office:	910.433.3300
Mooresville, NC Regional Office:	704.663.1699
Raleigh, NC Regional Office:	919.791.4289
Washington, NC Regional Office:	252.946.6481
Wilmington, NC Regional Office:	910.796.7215
Winston Salem Regional Office:	336.776.9800
NCDEQ DWM Afterhours Duty Phone:	919.817.0375



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