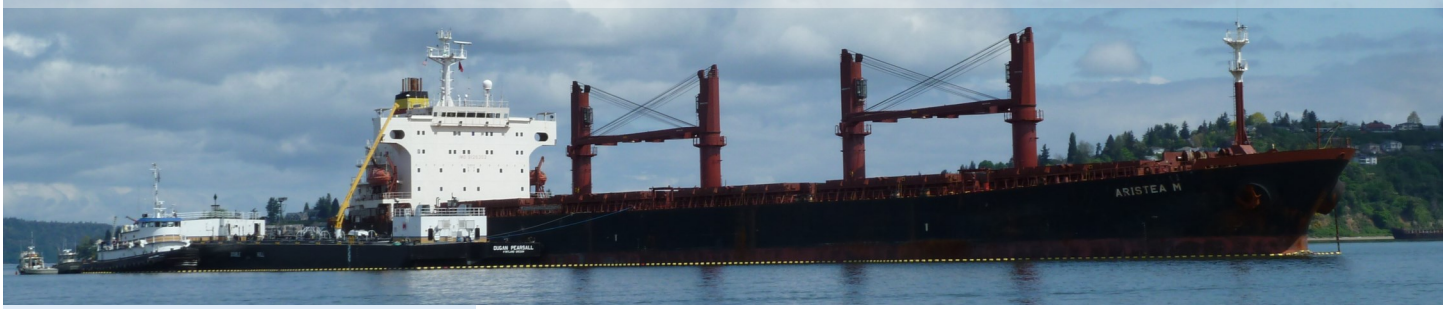
DEPARTMENT OF ECOLOGY
State of Washington

AUTOMATED TANK GAUGING, HIGH LEVEL ALARMS, AND OIL SPILLS



WHY IT MATTERS

Vessels have grown while crew size has remained the same or decreased, promoting an increased reliance on automation. During fueling and internal transfers many vessels use automated tank level gauging and alarm systems. It is important that this equipment be properly installed, calibrated, maintained, and operated in order to prevent oil spills.

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Overview

When properly calibrated, tested, and maintained, automated gauges and alarms are useful tools to determine tank levels. They warn vessel crews of high oil levels so a transfer is stopped before the tank overfills. Ecology has found such systems inaccurate or inoperative on some vessels. These systems can fail from improper calibration, poor installation, and/or poor maintenance. Inaccurate or malfunctioning gauges and alarms increase the risk of an oil spill and should be addressed as soon as possible.

Recommendations

Based on our inspections and investigations, Ecology makes the following recommendations regarding automated tank gauging and alarm systems:

- High level alarms should be tested prior to each oil transfer operation.
- Readings from tank soundings and/or local tank gauges should be compared to automated gauging information prior to each oil transfer operation. If a significant discrepancy is found, the reason for difference between the readings should be investigated, identified, and addressed prior to the transfer.
- Any malfunctioning automated oil tank gauges or alarms that are not immediately repaired should be logged, marked (tag-out if necessary), and communicated to appropriate crewmembers and company personnel.
- A vessel's safety management system should provide

Side of ship being cleaned after a fuel oil overflow involving failure of a tank level gauging system and overflow alarm.

A local gauge on a fuel oil settling tank showed an incorrectly low reading, while the computer display for the tank correctly indicated a high level condition in the tank.

procedures for conducting regular reviews of oil cargo, fuel and waste oil systems, and for the prompt repair of oil handling equipment including automated tank gauges and high level alarms.

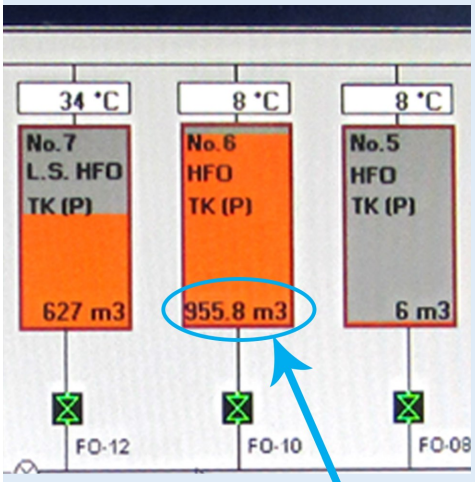
- Crews aboard new or recently modified vessels should be especially careful to ensure that tank level readings from manual soundings tables match the levels displayed by the automated gauging system.
- Engineering crews should keep detailed notes to provide oncoming engineers with information about deficiencies of the vessel's engineering systems, including oil tank gauging and alarm systems.

Do not assume that automated readings are always accurate. Even if the automated tank gauging and alarm systems have been regularly tested, maintained, and are verified as 'on', it is important to remain vigilant and to verify electronic readings with manual soundings and/or observations.

Case Studies

Below are some examples of automated gauging and alarm systems that Ecology found contributed to an oil spill or an increased oil spill risk.

- A tank barge spilled over 4,000 gallons of oil to Puget Sound while loading. Two high level warning alarms failed to sound. One alarm was likely turned off because it was generating a continuous alarm due to a damage-related open electrical circuit. The other alarm failed to sound because the oil level alarm switch was installed above the reach of the liquid in the tank top fitting. This prevented the float from reaching the sensor switch despite an overflowing tank. This high level alarm was improperly set years before and went undetected despite company and regulatory inspections. Following the spill, Ecology found multiple high level alarm switches were improperly set a second time during post-spill corrective follow-up, and had to be reset again.
- A bulk carrier on only its second voyage was loading fuel oil from a tank barge when it nearly overflowed a tank. The ship's personnel called for an emergency shutdown. The



	TANK	SOUNDINGS PRIOR BUNKERING	
		SDG	CBM
1	6 PORT	0.26	7.9
2	6 STBD	0.11	2.5
3	5 PORT	0.06	6.5

Prior to bunkering, a heavy fuel oil tank had a remote reading of 955.8 cubic meters (about full) while the manual sounding was 7.9 cubic meters (about empty). Discrepancies like this should be promptly addressed and communicated to appropriate crewmembers and company personnel.

barge tankerman complied. Despite having loaded less fuel than ordered and their plan to load the fuel tank to only 75 percent of the capacity, the ship's fuel tank was nearly full. The tankerman wisely refused to restart the fuel transfer. On further inspection it was found that the tank level monitoring system was inoperative, showing all fuel tanks empty or near empty. The crew was doing manual soundings, but the sounding tables were found to be calibrated to the wrong sounding tube height, giving them a false reading of how much oil was in the tanks.

- A bulk carrier spilled fuel oil to the Columbia River after overfilling the fuel oil tank during a transfer from a tank barge. The investigation found the magnetic float type fuel oil tank gauging system failed when the float jammed and gave an incorrect indication of the fuel oil level. The float stuck because the intermediate fuel oil became cold and viscous. It was found that the heating element that should have warmed the float tube and the fuel oil in it was not installed as required by the gauging system manufacturer. Furthermore, the fuel did not overflow directly from the tank being filled, but from an overflow tank connected to it. The overflow tank was fitted with an alarm that failed to operate when oil flowed into the tank. The overflow tank alarm was not tested before the transfer began.
- A container ship had a problem with two independent tank level monitoring systems. A tank loaded to 40 percent of capacity indicated empty on one automated gauge display, but on a separate monitoring computer screen it indicated a high and a high-high alarm condition. In total, five tanks were incorrectly alarming on one monitoring system or the other. Since this condition had persisted for at least six months, it appeared that all high level alarms on the fuel oil system were routinely ignored.

Automated gauging systems and high level alarms are valuable tools, but they are only as good as their installation, maintenance, and operation allows them to be, and under no circumstances are they an excuse for relaxed vigilance during oil handling operations.

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Related topics

Below are some examples of automated gauging and alarm systems that Ecology found contributed to an oil spill or an increased oil spill risk.

Safety Advisory Bulletin 09-01: Lessons Learned from Vessel Fueling Spills

Safety Advisory Bulletin 06-02: Oil Transfer Rates

Safety Advisory Bulletin: Marine Oil Transfer Spills and Inattention

Safety Advisory Bulletin 09-02 - Mobile Phone (Cell Phone) Use and Marine Operations

Focus on Internal Oil Transfers

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Program website:

www.ecy.wa.gov/programs/spills/spills.htm

Publication website:

http://www.ecy.wa.gov/programs/spills/prevention/preventionrecommendations.html

For more information

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