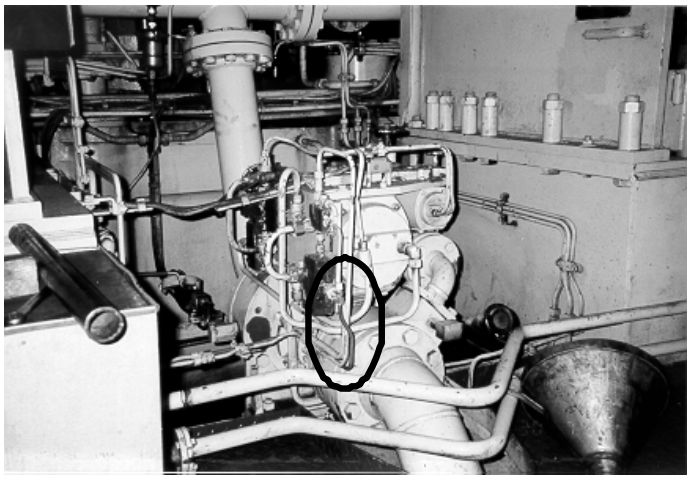
The Importance of Identifying and Addressing Root Causes of Equipment Malfunction

Lessons Learned

A number of incidents have occurred in Washington waters that illustrate the importance of correctly identifying and properly addressing equipment problems.

- A bulk carrier grounded on the Columbia River, endangering a dredge working nearby. The ship's steering gear failed during a turn. Fortunately, the ship was not holed but was sufficiently hard aground to require tugs to refloat it. Inspection of the steering engine room revealed that efforts had been made to provide additional cooling to the steering gear. Investigation revealed that the steering gear had failed again during the refloating attempt, and that the ship had lost steering before while underway at another U.S. port. The company was urged to have a comprehensive examination of the steering gear system to address the heat and intermittent failure problems.
- A container ship drifted to within about 400 yards of shore when it was unable to restart its main engine after stopping to pick up a pilot. The problem was with the ship's start air system. Moisture in the system caused slide valves in the starting air distributor to stick. Although the company had taken some precautions to deal with the ongoing problem, the efforts were not effective in this case. Several months later an inspection found the system had been modified to include manual drains for the high-pressure air receivers. It was also reported that some of the pilot air tubing on the main starting air valve had been renewed due to blocking problems on other vessels in the same class.



Main engine starting air valve that malfunctioned. Modification indicated by the unpainted copper tubing (circled).

WHY IT MATTERS

This bulletin was prepared to share lessons learned with industry and the interested public. Prevention recommendations are also made to prevent similar occurrences. Sharing lessons learned is important if Washington State is to achieve its "zero spills" goal.

WEBSITE INFORMATION

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

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- A tanker loaded with gasoline grounded on the Columbia River. The rudder angle indicator showed that the rudder was not moving. Following the grounding it was found that the rudder angle indicator had been deprived of power, but the rudder was still operable. The loss of power to the rudder angle indicator resulted from a failure in the ship's emergency electrical circuit. Inspection found an overheated lead in the emergency circuit, and it was replaced. Two months later, while at sea, the ship experienced a similar failure of the emergency circuit. Further examination of the problem revealed that the addition of electrical load to the emergency circuit, without adequate review of the impact on the system, was at the root of the problem.
- A ferry nearly grounded in Puget Sound. The ship lost propulsion, steering, and power. The cause of the loss was the opening of an electrical breaker due to overheating under a normal load. Investigation found that repeated opening of the breaker under load had previously occurred and had pitted the breaker contacts, causing overheating. The cause of the breaker opening events remained unidentified until the near-grounding, after which it was traced to an electrical component that was improperly set when installed some time before.

Each of these illustrates the need for ship operators to fully investigate equipment problems and to satisfy themselves that a root cause or causes (sometimes called basic or underlying causes) have been established.

Proper preventive maintenance is one of the foundations of the International Safety Management (ISM) Code. Section 9 of the ISM Code states "The SMS [Safety Management System] should include procedures ensuring that all non-conformities, accidents and hazardous situations are reported to the Company, investigated and analyzed with the objective of improving safety and pollution prevention. The Company should establish procedures for the implementation of corrective action." [Emphasis added.] Company procedures should include follow-up to ensure that corrective action was effective.

Section 10 of the ISM Code requires essential systems, such as those in the cases discussed above, to be fully functional and operational. "The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems." Vessel operators using root cause analysis will be well positioned to fully comply with the ISM Code requirement.

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