



The ANADYR

PREVENTION BULLETIN 99-01

OVERVIEW

On January 1, 1998, the M/V ANADYR spilled about 7,500 gallons of fuel oil into the Sitcum Waterway, in Tacoma, Washington. The spill occurred while the ship was taking bunkers from the tank barge DAVID-120. A side-by-side set of port and starboard double-bottom tanks were overfilled. Fuel oil spilled from the double-bottom tank vents located forward on the ship's main deck, overflowed fixed containment, and flowed aft down the deck of the ship. The oil subsequently made its way to the water triggering a significant containment and clean-up effort.

PROBABLE CAUSE

The immediate cause of the bunker spill from the ANADYR was overfilling the No. 1 double bottom tanks, port and starboard. Factors contributing to the spill were:

- a level of care inconsistent with regulatory requirements;
- inadequate situational awareness of the Person in Charge (PIC) of the bunkering operation aboard the ANADYR;
- deviation from the Chief Engineer's bunkering plan;
- failure of the communication system between the ship and the barge; and,
- failure to close the valves to double bottom tanks No. 1 port and starboard after the initial discharge from the port double bottom tank vent.



ANADYR's starboard side showing deck edge where oil flowed over the side.

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SAFETY ISSUES

The safety issues discussed in this report are the:

- importance of following safe bunkering procedures, whether they are required by federal, state, or company authorities;
- importance of a consistently high standard of care during bunkering operations; and
- importance of maintaining adequate situational awareness during bunkering operations, especially for the PIC.

VESSEL INFORMATION

ANADYR

The ANADYR is a 14 year-old general cargo ship designed to transport roll-on/roll-off and containerized cargo. It is 177.2 meters in length, and the gross tonnage is 18,627 tons.

Double bottom tanks (DBT) pair No. 1 (capacity about 1,200 barrels each) contained IFO (intermediate fuel oil) 180 as did deep tanks (DT) No. 2, 3 and 4. DBT No. 2 & 5 contained IFO 30 fuel. The tanks being loaded at the time of the spill were DT No. 4 (located between cargo hold No. 3 and No. 4) and DBT No. 1 port and starboard located beneath the forward portion of cargo hold No. 2.

DAVID 120

The DAVID 120 is a 16 year-old tank barge with a capacity of 53,490 barrels of oil and is 85.8 meters in length. The barge has a deadweight of 6,761 tons.

The DAVID 120 has a pump room/office house located aft on deck. On the morning of the spill, the starboard side of the DAVID 120 was alongside the port side of the ANADYR, with the DAVID 120's starboard manifold connected by a 6-inch hose to the ANADYR's port bunker header.

PERSONNEL

ANADYR

The common language spoken on the ship was Russian. It was observed that some officers and crew spoke English well enough to communicate in English without aid of a translator.

Five crewmen from the ANADYR were involved in receiving the fuel oil. The Chief Engineer was the PIC of the bunkering operation. The Third Engineer took the soundings and gave orders for valve alignment. A Motorman ("Motorman One") was stationed at the point of transfer on the port side of the ANADYR and controlled the radio and air horn for contacting the tankerman on the barge. A second Motorman ("Motorman Two") was stationed in the engine control room to monitor gauges and operate the valves. The Fourth Mate was the deck rover watch on the ANADYR.

DAVID 120

The DAVID 120 was crewed by 2 tankermen working in shifts, both English-speaking.

"Tankerman One" had worked about 4 years as a deck hand and 3½ years as a tankerman. He stated he had bunkered ships from the company operating the ANADYR before. "Tankerman Two" had worked for the barge company for about 8 months, and did about 10 bunker jobs per month. He thought that this was his first bunker job working with a ship from this company.

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ENVIRONMENT

Locale

The ANADYR was moored starboard-side-to a container terminal berth located on the northeast side of the Sitcum Waterway in the Port of Tacoma, Washington. The Sitcum Waterway tends southeast to northwest, opening to Commencement Bay at its northwestern extent.

Weather and Tides

Wind at the time of the spill was calm. The weather was overcast with rain, visibility was good, and the water surface smooth. Air temperature was 49 degrees F. A high tide of 13.6 feet was predicted for Commencement Bay, Tacoma at 0727. Twilight began at 0721 with sunrise occurring at 0757.

CHRONOLOGY

Preparations

The ANADYR arrived at Tacoma on December 27, 1997. Bunker training was recorded in the ship's deck and engine room log books as having been carried out at 2100 and 2200 on December 31st. Soundings of the ship's tanks were taken for the pre-bunker loading plan at 0100 on January 1st.

The barge arrived at the ANADYR at 0245 and was made fast alongside at 0255. The ANADYR's deck log records that the crew began plugging scuppers and making preparations for bunkering. At 0305, the hose was on the deck of the ANADYR. Tankerman One met the Third Engineer aboard the ANADYR. The Third Engineer wanted to complete the Declaration of Inspection (DOI), but Tankerman One requested the Chief Engineer. At about 0330 the Third Engineer and Tankerman One awakened the Chief Engineer, completed the pre-transfer conference in the Chief's office, and signed the DOI at 0340. Tankerman One and the Chief Engineer then went to the main deck and walked up the port side deck of the ANADYR to check the scupper plugs.

At about 0400 Tankerman One was relieved by Tankerman Two after reviewing the DOI together in the office aboard the DAVID 120. At 0415 Tankerman Two provided a radio and air horn to the Motorman aboard the ANADYR, locked the radio on Channel 72, reviewed the signals to stop the transfer, and demonstrated how to use the air horn. Tankerman Two checked the radio with his own to ensure they worked. At 0503 the hose was connected to the ANADYR.

The Transfer

Pumping began between 0500 and 0530. Tankerman Two stated that pumping began at a pump speed of 900 r.p.m.

According to Tankerman Two, 5 to 10 minutes after pumping began he received a hand signal from the Third Engineer and could hear him ask to increase pump speed. Tankerman Two recalled he increased the pump speed to 1300 r.p.m. and then began taking soundings of the DAVID 120's tanks at between 0515 and 0525. He stated he took a second set of soundings of the barge tanks about 45 minutes later. Tankerman Two recalled that after calculating a transfer rate of 330 to 340 metric tonnes/hour (mt/hr), about 1 to 1.5 hours into the transfer he slowed the pump to 1100 r.p.m. At 1100 r.p.m. he figured the pump would achieve a transfer rate of about 250 mt/hour.

According to the Third Engineer, he and the Chief Engineer conducted soundings together during the transfer. According to Tankerman Two, he walked the barge about every 30 minutes and stopped in the pump room on each round to check the pumps. He stated that he last visited the barge engine room about 15 to 20 minutes before the pump's shutdown.

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Events between 0720 and 0730 were recalled as follows:

- The Third and Chief Engineers completed soundings of No. 1 port and starboard DBT, noted that they were 75% to 80% full, and proceeded to the ANADYR's engine control room with the intent of closing the valves to these tanks and opening valves to No. 2 DT.
- The Third Engineer and the Chief Engineer walked aft to the superstructure, and the Third proceeded to the engine control room while the Chief proceeded towards his cabin.
- Motorman One saw oil spray out of the vent for No. 1 port DBT. He recalled that he tried to alert the tankerman by radio and air horn. Unable to make contact, he called the engine control room via radio. This radio was one of four ship's radios set to Channel 17 that were used by the bunkering crew to communicate with each other.
- The Motorman's radio call was overheard by the Third Engineer who was just entering the engine control room some 2 to 7 minutes after he completed his last soundings of the No. 1 DBT.
- The Chief Engineer received the radio call at his berth on his way down to the deck. The Captain of the ANADYR heard the radio call via the radio on the bridge of the ANADYR.
- The Third Engineer gave the command to the Motorman in the engine control room to open No. 3 DT.
- The Third Engineer then went to the DAVID 120 and met Tankerman Two near the port side of the barge's house.
- The Third Engineer approached Tankerman Two on the barge on the port side forward of the house, told him 'small problem', stated a vent burped, and asked him to shut down. Tankerman Two recalled it took 5 seconds to shut down the transfer.
- Tankerman Two said he asked the Third Engineer why he did not use the air horn or radio and received no verbal response from the Third Engineer.
- Tankerman Two then accompanied the Third Engineer to the bow of the DAVID 120 starboard side and was shown the spill from the forward port vent of the ANADYR. Tankerman Two said it was light enough to see a sheen in the water and the Third Engineer estimated it would take 20 minutes to clean up and there was no need to make notifications.
- Tankerman Two then notified the Captain of the tug BRIAN S. and the barge company's Qualified Individual (QI).

Following the spill, response efforts began. The ship's general alarm was sounded and the crew was called out to deploy absorbents. Boom was deployed by barge personnel at 0745. The Captain contacted the ship's agent and asked him to inform the Coast Guard and port officials of the spill. At 0810 the Washington State Maritime Cooperative was contacted by a barge company representative concerning the spill.

ANALYSIS

Violations Noted During the Investigation

Ecology investigators noted violations of Washington's bunkering regulations (Washington Administrative Code 317-40), the United States Code of Federal Regulations (CFR) Chapter 33 Subpart C, Sections 155 and 156, and the ship operator's own Bunkering Procedures Manual aboard the ANADYR. Deficiencies were noted in the areas of training, pre-load planning, the pre-transfer conference, completion of the Declaration of Inspection, determination of loading rate, work hours, and the ship owner's/operator's obligation to ensure compliance.

Communications

This investigation did not determine why the alleged attempts at air horn and radio communication

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from the ANADYR to the DAVID 120 requesting shut down were unsuccessful. The requisite communications were in place and checked for operation prior to the transfer, but, for an undetermined reason or reasons, the communication system did not bring about a rapid emergency shutdown.

A test on February 20th aboard the DAVID 120 called into question the effectiveness of the air horn in contacting the tankerman when he/she is located in the barge's pump room, and the reliability of the VHF radios in use aboard the DAVID 120. Another test conducted March 20th aboard the ANADYR called into question the effectiveness of using the hand-held VHF radios for communication aboard the ANADYR during all phases of the bunkering operation since a person on the main deck could not communicate directly with the engine control room from all locations.

Alertness/Fatigue

The bunkering operation of January 1st occurred between 0300 and 0730, a time of day when human alertness tends to be at its lowest levels.

No statement was made to investigators that indicated fatigue was a factor in this incident. However, because of the short duration of sleep obtained by some of ANADYR's crew before the spill, and because of the time of day during which the bunkering operation took place, fatigue cannot be ruled out.

Emergency Shut Down Actions

The Third Engineer, when asked if he closed the DBT No. 1 port and starboard tank valves, stated that he gave the command to open only DT No. 3, to reduce pressure. Two days later the Third Engineer stated that, after having DT No. 3 opened, he went up to the main deck and then down to the engine control room and closed valves to DBT No. 1 port and starboard.

The Third Engineer's statement regarding the alleged closing of DBT No. 1 port and starboard valves shortly after opening DT No. 3 was not reflected in his earlier statements when he was asked twice about his actions after finding out about the spill. Nor was it reflected by the Chief Engineer in his understanding of the events following the spill.

Investigators concluded that the spill from DBT No. 1 port and starboard occurred, in part, as a result of the DBT No. 1 port and starboard valves being left open. With the valves open and the transfer not shut down, DBT No. 1 port and starboard continued to fill and overflow.

Deviation from Planned Bunkering Procedure

The Chief Engineer stated that DBT No. 1 port and starboard took 2 hours to get to 80% full and that he thought he had more time before the tank reached 90%, maybe 20 to 30 minutes. This did not reflect the plan for bunkering that he wrote on December 31st. That plan indicated that DBT No. 1 port and starboard would be filled to 75 to 80% and then closed. Only later, by gravity fill from DT No. 4, were DBT No. 1 port and starboard supposed to have been filled to 90%.

The decision to load to 90% rather than the planned 75 to 80% resulted in a delay in closing the valves to the tanks, thus contributing to the spill.

Situational Awareness

On January 1st the Chief Engineer stated he believed a bubble in the DBT No. 1 tanks caused by rapid loading into small pipelines on the ship caused a spill out of the vent. This indicates that he did not

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have a clear understanding of the circumstances of the spill since the volume that spilled was significantly larger than what could be expected from a bubble. On January 3rd the Chief Engineer stated the spill was caused by a list, oil flowing into DT No. 3, and water on deck from rain that caused run off over the side.

The Chief Engineer's changing views of the spill cause, as well as his lack of knowledge of the transfer rate, indicated that his situational awareness was compromised. This contributed to the spill because the Chief Engineer was unable to accurately judge the status of the DBT No. 1 port and starboard tanks and, therefore, unable to prevent them from being overfilled.

Transfer Rate

Transfer rates were calculated by investigators based on the timeline derived from the Daily Barge Log and Tankerman Two's statements regarding the rate he calculated 1 to 1.5 hours into the bunkering operation. Tankerman Two stated that he slowed to 1100 r.p.m. after he made a calculation that indicated the delivery rate of 330 to 340 mt/hour. At 1100 r.p.m., Tankerman Two figured the pump would achieve a transfer rate of about 250 mt/hour.

During the course of the investigation the Chief Engineer stated, in hindsight, that the rate of transfer was faster than expected. The Third Engineer, when asked if he was aware of the transfer rate prior to the spill, stated that he was not aware. The Third Engineer also stated that it should not have exceeded 250 mt/hour.

The "Master's Requisition" dated January 1, 1998 and signed by the Chief Engineer also indicates under "Requested rate per hour for delivery:" a rate of "250 max." The communication between the Chief Engineer and Tankerman One, reinforced by the Master's Requisition reference to a loading rate of "250 max" apparently set up an expectation that 250 mt/hour would be delivered.

Calculations done using timelines based on accounts provided by Tankerman Two and the ANADYR's deck and engine logs result in transfer rates of between 334 and 564 mt/hour. Based on the information gathered it appeared that neither party possessed wholly reliable information regarding transfer rate, and the Chief Engineer relied on the agreed-upon rate rather than calculating the rate himself based on sounding information.

Watch Change During Transfer

The barge company's Spill Prevention Plan states, "The Declaration of Inspection will be re-signed at the change of each watch and/or transfer location for bulk petroleum transfer." A copy of the DOI provided by the barge company shows that the document was signed by Tankerman Two at the change of the watch in compliance with the policy. However, it was not reviewed with the ANADYR's PIC but between the tankermen, and then signed by Tankerman Two.

CONCLUSIONS

- The violations indicate a level of care during the operation inconsistent with regulatory requirements; a level of care that may be interpreted as complacency.
- The Chief Engineer was not sufficiently aware of the status of the bunkering operation. This compromised situational awareness contributed to the overfilling of DBT No. 1 port and starboard.
- The Chief and Third Engineers deviated from the Chief's plan by continuing to fill DBT No. 1 port and starboard above the planned level of 75 to 80% full. This deviation delayed the closing of the valves to these tanks and contributed to the spill.

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- The communications system between the ship and the barge failed to ensure a rapid emergency shutdown at the first sign of oil.
- The Third Engineer ordered the opening of the valve to DT No. 3 upon hearing of the spill but did not close the valves to DBT No. 1 port and starboard, allowing those tanks to continue to fill until emergency shutdown was accomplished.

LESSONS LEARNED

- Regulations, company policy, plans, and checklists together set standards for safe bunkering. It is not enough to maintain copies of regulations, company policies, plans, and checklists; one must also comply with them to assure safe bunkering.
- Maintaining situational awareness is critical during any maritime operation, be it underway or while conducting operations alongside. Situational awareness is particularly important for watchstanders and PICs.

PREVENTION RECOMMENDATIONS

To Ship Owners and Operators:

- Ensure the company bunkering procedures, and all applicable regulations, are understood by ships' crews and complied with.
- Ensure crew members conduct soundings and record innages or ullages at regular intervals and use the information to calculate and record the rate of transfer. If the rate of transfer is unacceptable, crew members should be instructed to contact the delivering vessel or facility immediately.
- Emphasize teamwork during bunkering training to help maintain situational awareness.
- Emphasize the dangers of complacency during oil transfers to crews by publicizing lessons-learned from bunkering spills and near-spills.
- Ensure that all PICs complete the DOI, not as a matter of routine, but as an important check on transfer readiness.
- Ensure that the crewmember tasked with controlling tank valves has an effective means of communication with the person on deck conducting soundings of tanks.
- Ensure that crew members are given sufficient time off to get adequate rest prior to conducting bunkering procedures, and that they understand the importance of adequate rest and the dangers of working while fatigued.
- Ensure that any problems experienced with VHF radios used for transfer operations are reported and corrected promptly.

To Barge Owners and Operators providing bunkering services:

- Adopt procedures to require that a tankerman coming on watch review and sign the DOI with the receiving vessel's PIC before taking over the transfer watch.
- Ensure that any information provided to the ship explicitly states that transfer rates may vary from the agreed upon rate and that the receiving vessel should contact the tankerman immediately if they note any problem with the transfer rate.
- Ensure that any problems experienced with VHF radios used for transfer operations are reported and corrected promptly.
- Ensure tankermen take precautions to ensure at least one reliable means of being contacted by the vessel is always available.
- Emphasize the dangers of complacency during oil transfers to barge personnel by publicizing lessons-learned from bunkering spills and near-spills.

More Prevention Bulletins

PREVENTION BULLETIN 95-02

The VERBIER

OVERVIEW

On July 10, 1994, at about 1900 hours, the VERBIER, a Panamanian-registered bulk cargo vessel in poor material condition, was forced to shut down her main propulsion because of mechanical failure. The vessel was outbound to Tunisia from Vancouver, British Columbia, loaded with 28,165 metric tons of sulfur in bulk. While in Vancouver, the vessel had been detained by the Canadian Coast Guard for multiple SOLAS violations.

When the Captain stopped the engine, the VERBIER was approximately 2.8 miles due south of Beechey Head, in Canadian waters of the Strait of Juan de Fuca. The VERBIER was in the outbound traffic lane when the Master stopped her engine. The vessel drifted in a southeasterly direction at approximately one nautical mile per hour (one knot).

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The KEYSTONE CANYON

OVERVIEW

On October 26, 1994 at about 1200 hours, the KEYSTONE CANYON, a U.S. flagged tank vessel, was towed off Pier One in Astoria, Oregon, parting or paying out all her mooring lines. After several failed attempts by the Master to regain control and maneuver the vessel, the vessel collided with the Scola-Meyer Bridge then grounded along the west side of the bridge.

The KEYSTONE CANYON was in ballast at the time of the grounding but was carrying approximately 14,676 barrels of tanker "C" fuel oil, 1,772 barrels of diesel oil, and 3,800 barrels of slugs (dry water). The incident resulted in the loss of oil and no injury to crew members. Two bridge abutments received minor damage.

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The BARGE 101

OVERVIEW

On December 30, 1994, BARGE 101 grounded while being towed by the tug MERCURY to Jack Island, Washington (near Anacortes) from Vancouver, British Columbia. At the time of the grounding, BARGE 101 was carrying 62,404 barrels of number two diesel oil, and had a draft of 16-foot 5 inches forward and 14-foot 5 inches aft.

The grounding punctured the number four and six starboard cargo tanks. Damage to the bottom of BARGE 101 was found on the starboard side of the confine, beginning at midships and continuing aft in an almost straight line to the stern of the barge. The bottom plating was upset approximately four to six inches in the stern area, with deeper spots and fractures in cargo tanks number four and six starboard, near the turn of the bilge.

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The ARCADIA

OVERVIEW

On October 22, 1996, the Greek-flag tanker ARCADIA was being piloted inbound through the Strait of Juan de Fuca for refinery at Anacortes, Washington with a cargo of approximately 250,000 barrels of fuel oil. As the ARCADIA, under escort by two tugs, approached the precautionary area near buoy "RA", enroute to Rosario Strait, the ship lost steering control. The ARCADIA ran aground part and crossed the intended path of the outbound American-flag tanker ARCO FAIRBANKS, also partially laden and under tug escort.

The pilots of the two vessels were in communication with each other by radio. The ARCADIA's pilot continued the turn to port once steering control was restored, eventually completing a 346 degree turn to bring the ARCADIA back to its intended course.

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The VERBIER (11/95)

The KEYSTONE CANYON (2/96)

The BARGE 101 (12/96)

The ARCADIA (6/98)

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