

The COSMOS EXPRESS/ INVESTIGATOR

Overview

On Monday evening, December 4, 2006, the car carrier COSMOS EXPRESS was moored with its starboard side against Berth 10 in Vancouver, Washington. The tank barge INVESTIGATOR was moored with its port side on the ship's offshore (port) side. Following a transfer of diesel oil to the car carrier COSMOS EXPRESS, the Tankerman-Person in Charge (Tankerman-PIC) of the tank barge INVESTIGATOR disconnected the barge's hose from the ship's hose. The unsupported ship's transfer hose swung out over the port side of the barge, spilling diesel onto the deck of the barge and into the Columbia River. The spill to water was reported to the U.S. Coast Guard (USCG) and Ecology by the ship. About 53 gallons (200 liters) of diesel spilled from the hose into the water, but the Tankerman-PIC only reported a small spill of diesel to the deck of the barge. The ship departed with USCG approval. The next day diesel was found in the Columbia River just downstream of Berth 10, and the Tankerman-PIC admitted that oil had spilled to the water.



Figure 1 - March 2006 photograph of the tank barge INVESTIGATOR with tug ARIES.

WHY THIS MATTERS

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

See pages 12 and 13 of this bulletin for the list of lessons learned and prevention recommendations.

The companies operating the ship and tank barge were offered the opportunity to provide additional information. The operators described changes they made following the spill.

WEBSITE INFORMATION

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

Special accommodations:

If you need this publication in an alternative format, call the Spills Program at 360-407-7455. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.

Factual Information

Tank Barge Information

The INVESTIGATOR was a 214-foot (65-meter), 1,730-gross ton double-hulled tank barge built in 1981 operating under a U.S. flag.

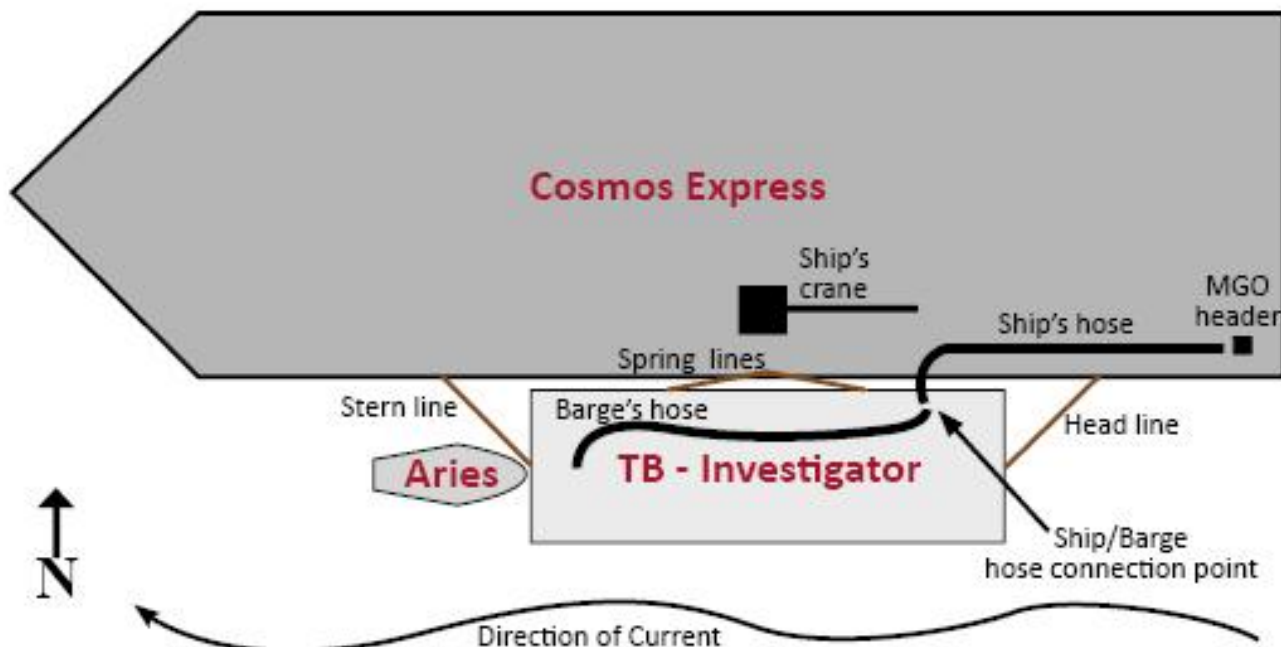


Figure 2 – Diagram based on a sketch by the Tankerman-PIC [not to scale] showing the approximate orientation of the COSMOS EXPRESS, INVESTIGATOR, and tug ARIES. North is up.

The marine diesel oil transfer of December 4 was carried out using, in part, three joined lengths of collapsible rubber hose aboard the barge. The hoses consisted of two 35-foot (11-meter) and one 40-foot (12-meter) hose. These were led forward from the manifold on the port side of the barge (Figure 2). The forward-most hose terminated in a quick connect/disconnect coupling. The barge supplied an adaptor for the ship's hose to mate with the coupling of the barge's hose. The adaptor was attached to the ship's hose with four bolts and a gasket by the Tankerman-PIC with assistance from the Captain of the tug ARIES. The ARIES handled the INVESTIGATOR and was tied to the stern of the barge during the transfer.

The INVESTIGATOR had a Tankerman-PIC aboard when the spill occurred. He had been employed by the barge's operator for about 18 months. He had conducted, by his estimate, about 75 to 100 transfers aboard the INVESTIGATOR. Prior to the transfer of December 4, he had been off for two days (Saturday and Sunday). The ARIES had a Captain and two deck hands aboard when the spill occurred.

Ship Information

The COSMOS EXPRESS was a 541-foot (165-meter), 24,930-gross ton car carrier built in 1978 operating under the Panamanian flag.



Figure 3 - The COSMOS EXPRESS. [Photographed at Tacoma, Washington on, February 13, 2007.]

The ship's heavy fuel oil manifold was located on the ship's upper deck about half the ship's length from the bow (Figure 4).



Figure 4 - Port side midship fuel oil bunker station aboard the COSMOS EXPRESS.

[Note: On December 4, 2006 only the right (forward) of two header pipes existed. The second pipe at left connected to hose was added after the spill.]

The ship's light oil (marine gas oil, marine diesel oil) manifold was located on the port side of the upper deck near the stern of the ship (Figure 5). The ship had a crane on the port side that could be used to support the bunkering hose (Figures 6 & 7). The ship's freeboard from the upper deck

where the manifolds were located, to the deck of the barge INVESTIGATOR was about 52.5 feet (16 meters).



Figure 5 - Port side diesel/marine gas oil fuel header located on the ship's upper deck. On the day of the spill, the ship's transfer hose was led forward between the large white hold ventilator fan housing (center of photo) and the ship's rail.

[Photograph taken February 13, 2007.]



Figure 6 - Location of the starboard side crane aboard the COSMOS EXPRESS. The port side crane, used for the transfer of December 4, 2006, was located directly across the ship on the port side. [Photograph taken February 13, 2007.]



Figure 7 - Port side crane aboard the COSMOS EXPRESS. Photo was taken from just forward of the port side diesel/marine gas oil header looking forward. [Photograph taken on February 13, 2007.]

For the marine diesel oil transfer, the ship used two 66-foot (20-meter) lengths of 4-inch (10 centimeter) rigid rubber hose coupled together with one flange connected to the ship's light oil header. The first 66-foot length of hose and 6.5 feet (two meters) of the second length were laid out on the upper deck of the COSMOS EXPRESS leading forward from the light oil manifold on the port side. About 6.5 feet (two meters) of the ship's hose was reportedly on the deck of the



barge. A 52-foot (16-meter) section of hose hung, unsupported, over the ship's side to the deck of the barge (Figure 8).

Figure 8 - The ship's rigid transfer hose was led over the side of the ship at the bend in the deck rail for the gangway's stowage. [The end of the gangway is highlighted at the upper center of this photograph with yellow and black diagonal striping.]

Environment

The weather on Monday, December 4, at 1800 was cloudy with a temperature of 45 degrees Fahrenheit (about 7 degrees Celsius). Winds were from the Southeast at 4 to 6 knots. The tide was falling.

Analysis

Barge Positioning

The information gathered indicated that the hose connection between the ship and barge hoses was positioned a few meters beyond the reach of the ship's crane. The connection point was at the deck of the barge. If the barge had moved aft (from the perspective of the tug and barge, forward from the perspective of the ship) a few meters the connection between the ship and barge hoses would have been supported by the ship's crane. A bollard (mooring point) was set in the side of the ship just aft of amidships, and the bollard was adjacent to the amidships point on the barge, so it appears the mooring configuration of the barge and ship would have supported a shift in position of the barge to allow the crane to reach the connected hoses.

Another possible mooring configuration, discussed by the Tankerman-PIC and the tug's Captain, would have been to flip the barge around to face downstream.

If the ship's crane was able to reach the connection between the ship and barge hoses it likely would have provided more control and prevented the ship's hose from escaping the Tankerman-PIC's grasp as he uncoupled the camlock fitting.

The Tankerman-PIC and Second Engineer were consistent in their estimate of a three to six foot (one to two meter) gap between the side of the ship and the side of the barge when the spill occurred. The gap added outboard tension to the transfer hoses and put the free end of the ship's hose over the water, rather than the barge's deck, once the connection escaped the Tankerman-PIC's grasp. This gap was larger than what might typically be expected during a bunkering operation where large fenders are used to fend the barge off from the side of the ship.

The Tankerman-PIC alleged that the gap was larger due to the presence of a ship assist tug idling just aft of the ship (see Figure 4).

Analysis of the relative positions of the ship and barge indicate that a tug idling immediately aft of the ship would have been at least 130 feet (about 40 meters) upstream of the barge, giving some time for any propeller wash from the ship assist tug to dissipate in the river current prior to reaching the barge.

One may accept the view of the Tankerman-PIC that it was the propeller wash from the waiting ship assist tug that moved the barge away from the ship rather than, for instance,

CHRONOLOGY

Sunday, December 3, 2006

1130 Pre-bunker training was held aboard the COSMOS EXPRESS.

Monday, December 4, 2006

0518 The COSMOS EXPRESS was docked alongside Vancouver, Berth 10.

0630 The INVESTIGATOR's Tankerman-PIC came on duty.

0700 to 0730 The INVESTIGATOR, pushed by the tug ARIES, came alongside the COSMOS EXPRESS at Port of Vancouver, WA, Berth 10 and was moored there. The barge's arrival drafts were 6 feet (1.8 meters) forward, 8 feet 3 inches (2.5 meters) aft.

0800 to 0825 A pre-transfer conference was held.

0815 A single 6-inch (15 centimeter) transfer hose for the intermediate fuel oil (IFO) transfer was connected between the INVESTIGATOR and COSMOS EXPRESS.

0825 The Declaration of Inspection (DOI) was signed.

0845 The INVESTIGATOR began delivering 1,098 metric tonnes ("tonnes") of IFO-180.

1430 The ARIES contacted the tug and barge Dispatcher to inform him that they would be late for the next job. Estimated time for completion was 1800.

1545 The transfer of IFO was completed and the hose was disconnected.

1600 The crew of the COSMOS EXPRESS lowered a hose to the INVESTIGATOR in preparation for a transfer of marine diesel oil.

1700 to 1740 A 4-inch (10-centimeter) hose from the barge was connected to the ship's hose for the diesel transfer. A leak in the hose gasket was found, and the gasket was replaced. The Captain of the ARIES assisted the Tankerman-PIC with a leak at the hose coupling between the ship's hose and barge hose.

loose mooring lines in combination with river current. The assist tug arrived at Berth 10 from Berth 9 further upstream at 1730, about one hour prior to the spill. This afforded ample time for the Tankerman-PIC and the tug's Captain to have the situation corrected. Either man could have contacted the ship assist tug or have adjusted the barge's mooring prior to the Tankerman-PIC disconnecting the barge hose from the ship's hose with the connection under tension.

Hose Configuration

The Tankerman-PIC was unfamiliar with a hose configuration of combined lengths of collapsible barge hose with and lengths of rigid ship's hose. According to the tug and barge dispatcher (Dispatcher), the hose configuration was also beyond his (longer) experience as Tankerman-PIC.

The marine diesel oil header on the ship was located well aft of the fuel oil header, and near the stern of the ship. The combination of hoses was used to allow the transfer of diesel oil to occur without moving the barge. The transfer connection was further complicated because neither the barge nor the ship crane could be used to support the connection of the ship and barge hoses over the deck of the barge.

The hoses were connected using a quick connect/disconnect fitting. The Tankerman-PIC attached an adapter to the flange of the ship's hose in order to connect to the barge's hose. The gasket between the adapter and the ship's hose flange leaked twice at the start of the transfer. After each leak the transfer had to be stopped, the hose drained, and the connection re-done. The tug Captain assisted the Tankerman-PIC to achieve a leak-free

1720 A Columbia River Pilot arrived aboard the COSMOS EXPRESS.

1730 One hour notice of departure was passed to the engine room crew of the COSMOS EXPRESS.

An assist tug shifted from Vancouver Berth 9 (about 880 feet (268 meters) upstream of Berth 10) to Vancouver Berth 10, waiting to assist with the COSMOS EXPRESS's departure.

1750 The INVESTIGATOR began delivering about 38 tonnes of diesel. The transfer rate was about 40 tonnes per hour.

1800 The Columbia River Pilot assigned to the COSMOS EXPRESS asked the Master of the ship what time he expected to depart. The Master told him about 1900.

1805 The Tankerman-PIC noted the transfer rate was "really slow."

1830 The Tankerman-PIC noted in the barge log "Tnk [tankerman] spill a little fuel on barge – fill out near miss report."

1840 The ship's deck log recorded "Oil spill reported; hose mishandled by barge."

1846 to 1917 The COSMOS EXPRESS notified their local oil spill response coverage provider, the USCG, ship's agent, Qualified Individual (QI), and state authorities of Oregon and Washington State of the spill.

1912 The tug and barge Dispatcher first learned of the spill while he was at home. He was told by the Captain of the tug ARIES that it consisted of a couple of gallons on the deck of the barge.

1927 An Ecology Responder participated in a conference telephone call with the USCG Sector Portland, Vancouver Fire Department, and the Marine Exchange of Portland. During the call, he twice requested the COSMOS EXPRESS not be allowed to leave before an initial investigation on-scene could be completed by Ecology personnel.

1935 The ship's agent notified the ship's pilot that the USCG had cleared the ship to sail, the pilot then informed the Master of the ship.

connection between the adaptor and the ship's hose flange. This delayed the bunkering operation and likely increased the pressure felt by the Tankerman-PIC to complete the job.

1945 to 2000 The INVESTIGATOR departed. The COSMOS EXPRESS cast off mooring lines from the berth to get underway.

2030 The Tankerman-PIC departed the dock.

The quick connect/disconnect coupling used in this transfer closed using metal "ears" of the fitting of one hose to snap into a groove of the fitting on another hose. Unsnapping either ear opens the connection. This type of coupling cannot be loosened as can a standard flange connection by partially loosening the bolts. The "all open" or "all closed" nature inherent to this type of coupling set the stage for loss control of the ship's hose by the Tankerman-PIC. Due to the positioning of the barge away from the side of the ship, the Tankerman-PIC lost control suddenly as he opened the coupling with the weight of the ship's hose under tension. Instead of opening the coupling, the Tankerman-PIC could have loosened the bolts holding the coupling adaptor to the ship's hose to maintain better control of the connection while draining residual diesel from it.

Hose Draining Procedures

Typically, after a bunkering operation using only the hose supplied by the barge, the hose is either sucked dry using the barge's pump or drained dry by gravity. In either case, the draining of the hose can occur because air is introduced at the ship's end of the hose to break the vacuum. Air is introduced by either opening a bleed valve at the ship's header or by breaking the connection between the barge's hose and the ship's flange.

According to the Dispatcher, the draining process for diesel is typically done by gravity. According to the Second Engineer, the Tankerman-PIC never asked ship personnel to close their header valve. While this could have allowed the oil to drain back to the barge from the rigid ship's hose, it could also have introduced a siphon, pulling residual diesel from the ship's diesel piping.

There was substantial discrepancy between time estimates of the Tankerman-PIC and the Second Engineer as to how long the ship's hose continued to drain after the Tankerman-PIC disconnected the ship and barge hose. The Tankerman-PIC indicated it drained for two seconds, while the Second Engineer estimated 30 seconds. The Tankerman-PIC did not know how much oil drained to the water. The Second Engineer estimated it was no more than the volume of the ship's hoses.

Tankerman-PIC Experience

The Tankerman-PIC stated he had been employed for about 18 months in that position. In that time he estimated he had completed about 75 to 100 transfers aboard the tank barge INVESTIGATOR.

However, the Dispatcher indicated he believed the Tankerman-PIC was "fresh" (inexperienced)

despite his otherwise positive assessment of the Tankerman-PIC's work. The Dispatcher also indicated that the hose arrangement used in the transfer was beyond even his four-year experience as a tankerman.

There were other signs that the Tankerman-PIC's experience was an issue in this spill:

- He did not insist on adjusting the position of the barge to allow a crane to support the transfer hose, though he did mention it in conversation with the tug Captain and Dispatcher.
- He required assistance from the tug Captain to complete a leak-free connection between the ship's hose flange and the coupling adaptor.
- He felt he could have used help with the hose disconnection, but did not ask the tug crew for help.
- He did not undertake efforts to decrease the distance between the ship and the barge before disconnecting the coupling.
- He did not know if the ship had a way of introducing air into the hose to break the vacuum.
- While recognizing that the failure of the barge hose to collapse after draining out the diesel was out of the ordinary, he did not stop to consider why or to take additional precautions before proceeding further.
- He opened the coupling with the hose under tension rather than loosening the bolts on the adaptor to ensure the hose had drained properly and to maintain control of the hose.
- He did not ask for help and was just trying to get out of there.

The Tankerman-PIC's limited experience appears to have contributed to this spill.

Alertness/Fatigue

The Tankerman-PIC reported that when he worked 12 hours on and 12 hours off while aboard a tug the prior week, he got 10 hours of sleep per day. He got a similar quantity of sleep on Saturday and Sunday nights immediately prior to the Monday spill. He reported he had no sleep problems, awoke rested, and awoke either on his own or with assistance from an alarm. He reported the time it takes for him to fall asleep was about 20 minutes.

When the spill occurred the Tankerman-PIC had been awake for 12.5 hours and on the job for 12 hours. He was therefore within his regulatory work hour limit of 15 hours.

Following the spill of December 4, the Tankerman-PIC failed a post-incident drug test. It was not determined if the tankerman's drug use impacted the transfer operation that resulted in the spill. It does not appear that reduced alertness or fatigue was a factor in this spill, but, given the Tankerman-PIC's positive post-incident drug test, poor sleep quality or reduced sleep quantity as the result of drug use cannot be ruled out.

Commercial Pressure

The Tankerman-PIC stated that he didn't bother asking for help with disconnecting the hoses and just wanted to get out of there. There were a number of factors that were present to increase pressure on the Tankerman-PIC to complete his work quickly:

- Being "bugged" [asked frequently] by the crew on the ship about the speed of the transfer.
- His belief that the ship was paying for the delay.
- The presence of the pilot aboard the ship.
- The presence of the ship assist tugs.
- The calls from his Dispatcher.
- The Chief Engineer asking him to speed up the transfer.
- The slowness of the IFO transfer.
- The delay in completing a leak-free connection on the diesel hoses.

The Tankerman-PIC's relative inexperience combined with these factors, likely contributed to decisions he made that favored quick completion of the transfer over caution.

Initial Report/Notification

The Master of the COSMOS EXPRESS made notifications to appropriate authorities and the ship's contingency plan provider of the spill, and estimated the spill volume at about 53 gallons (200 liters) to water.

Information provided to the USCG and Washington State by the barge company regarding the spill indicated that no oil was spilled to the Columbia River. This was based on incorrect information the Tankerman-PIC reported to his employer. The Tankerman-PIC also did not tell the Captain or crew of the tug ARIES of the spill of oil to the Columbia River.

On the day after the spill, when diesel oil was found on the Columbia River near Berth 10 and when the Dispatcher confronted the Tankerman-PIC regarding it, the Tankerman-PIC admitted that oil was spilled to the water. In his written statement for the USCG the Tankerman-PIC wrote, "...Then I notified my dispatch but didn't tell them MGO [diesel] was in the water because I was afraid of losing my job."

Causal Information

Based on the information gathered, the immediate cause of the spill was the Tankerman-PIC's failure to control the unsupported diesel transfer hose. Factors contributing to the spill included:

- The positioning of the tank barge alongside the ship by the Captain of the ARIES in such a way that the diesel transfer hose connection could not be supported by a crane.
- The decision of the Tankerman-PIC to continue the transfer despite the additional tension placed on the hose connection by the one to two meter gap between the ship and the barge.

- The “all open” or “all closed” design of a hose connection fitting that was used under the circumstances by the Tankerman-PIC rather than a more cautious, but available, approach to disconnecting the hoses.
- The Tankerman-PIC’s limited experience.
- Pressure felt by the Tankerman-PIC to complete his work quickly.
- The Tankerman-PIC’s failure to request assistance to disconnect the diesel transfer hose.
- A lack of active supervision and assistance provided to the Tankerman-PIC, despite:
 1. The Tankerman-PIC’s limited experience.
 2. The Tankerman-PIC’s comments regarding the positioning of the barge.
 3. The difficulty the Tankerman-PIC had in making the diesel hose connection.
 4. The unusual nature of the diesel transfer hose connection.
 5. The factors present to increase the pressure felt by the Tankerman-PIC to complete the transfer quickly.

Lessons Learned

- Non-standard or unusual operations will occur from time to time. Non-standard or unusual operations require a higher level of planning and foresight by personnel involved to ensure that they proceed safely.
- Non-standard or unusual operations may require the foresight that can only be provided by more experienced personnel.
- When non-standard or unusual operations occur, less experienced personnel should be fully supported by more experienced personnel to ensure that the operation proceeds safely. The more experienced personnel should not wait to be asked by the less experienced before assisting when such operations occur.
- Non-standard or unusual operations, higher than usual commercial pressure, and inexperienced personnel are potent precursor conditions for accidents – especially in combination. All personnel involved in operations under one or more of these conditions should exercise particular caution.

Prevention Recommendations

To tank barge operators:

- Ensure that supervisors and more experienced personnel actively assist less experienced personnel to ensure safe operations when indicators are present that such assistance is called for.
- Review the use of quick connect/disconnect couplings aboard your tank barges, and ensure your procedures and tankermen training adequately address any special considerations

regarding their use.

- Ensure your company policies, procedures, and training materials emphasize safety over commercial considerations in order of precedence.

In reviewing this spill the former operator of the COSMSO EXPRESS (which was scrapped in January 2009) implemented the following measures:

- Flexible bunker hoses are not allowed on any vehicle carrier with high sides in order to reduce the potential risk of having a coupling point hanging in mid-air.
- Engineers are told that under no circumstances shall disconnection of any bunker line be allowed without effective draining or blowing through, regardless of the pressures to complete the operation and sail quickly.

In reviewing this spill the operator of the INVESTIGATOR implemented the following measures:

- Separating employees into two testing pools, one pool for tankermen and one for vessel (tug) personnel increased the likelihood of an individual employee being randomly tested for drug use in a given year.
- Tankerman training was increased to address the issues associated with this spill, such as policy not being followed and hose handling procedures.
- All hands were reminded that any spill, regardless of severity, must be treated as a spill to the water to ensure that company management is always called.

MORE PREVENTION BULLETINS

PB 09-02 The CICLOPE (ECY 09-08-014)

PB 09-01 The DEFENDER (ECY 09-08-002)

PB 08-02 The CATHERINE QUIGG
(ECY 08-08-007)

PB 08-01 The ALLEGIANCE (ECY 08-08-001)

PB 07-01 The SEA SYNERGY (ECY 07-08-009)

PB 06-01 The PACIFIC EXPLORER
(ECY 06-08-018)

PB 06-02 The NOHO HELE (ECY 06-08-037)

PB 05-01 The TAI SHAN HAI (ECY 05-08-004)

PB 03-01 The OVERSEAS WASHINGTON
(ECY 03-08-001)

PB 01-02 The ARCO TEXAS (ECY 01-08-006)

PB 01-01 The SUPER RUBIN (ECY 01-08-002)

PB 99-02 The MONCHEGORSK (ECY 99-261)

PB 99-01 The ANADYR (ECY 99-250)

PB 98-01 The ARCADIA (ECY 98-253)

PB 96-21 BARGE 101

PB 96-01 The KEYSTONE CANYON

PB 95-02 The VERBIER

PB 95-01 The DONA

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