

UNITED STATES COAST GUARD

ADDRESS REPLY TO:
COMMANDANT
U.S. COAST GUARD
HEADQUARTERS
WASHINGTON 25, D.C.



MVI
(S-21 a-8 Bd)
8 MAY 1961

Commandant's Action

on

Marine Board of Investigation; explosion and fire
on board the M/V S-21 on 21 September 1960, with
loss of life

1. The record of the Marine Board of Investigation convened to investigate subject casualty together with its Findings of Fact, Opinions and Recommendations has been reviewed.
2. The self-propelled, oil well drill tender S-21, formerly the LST 769, was moored bow to the California Company drilling platform 7-X which is located in Block 26, Grand Isle area, Gulf of Mexico. While attending the drilling platform, where the plugging of a gas well by "cementing" or "killing" was in progress, an explosion and fire occurred at about 1822 CST on 21 September 1960 involving the vessel's pumproom and adjoining spaces. Of the 11 crew members and approximately 43 oil workers aboard the vessel, one crew member was killed and two crew members were injured and six oil workers were injured. Damage to property was estimated at \$12,500.
3. The pumproom is a compartment located on the centerline of the 3rd deck in the after half of the vessel. Integral mud pits are constructed at the forward end of the pumproom. The deckhouse with its quarters and messing facilities is on the main deck over the after third of the compartment. The vessel's dry storage area, including the reefer space, is located immediately aft on the 3rd deck. At the time of the casualty, the watertight door between the dry storage area and the pumproom was secured, although a circulation of air between these two spaces existed through open watertight closures to and through the machinery spaces in the hold directly below. The pumproom ventilation was provided by an exhaust fan that vented on the boat deck and its ducting that extended into the pumproom at about the 2nd deck level. In addition, a hatch, located over the forward half of the pumproom, was partially opened.
4. Mud pumping equipment that belongs to the Halliburton and Noble Companies, subcontractors for the California Company, is located in the pumproom and is used exclusively in well drilling and production operations. These pumping units are temporarily installed in the

pumproom for the period of the contract. Since this equipment is used exclusively in the drilling for, and the production of oil, gas, petroleum and other subsoil minerals, it is exempted from inspection by the Coast Guard.

5. The Halliburton unit is mounted on a skid and consists of two high pressure pumps, their diesel engines, and measuring tanks. This unit is located on the port side aft in the pumproom. The Noble pump with its engine is placed forward of the Halliburton unit and is used to supply mud from the vessel's mud pits to the measuring tanks on the Halliburton unit. A discharge line from each Halliburton pump joins in a "T" or "Y" arrangement, and the common line runs through and on the ship to the bow and then to the "Christmas Tree" on the platform. The "Christmas Tree" consists of a group of valves at the top of the well. Except for a manual discharge valve at each pump, there are no other valves in the line between the pumps and the "Christmas Tree." At the time of the casualty, the No. 2 Halliburton pump was inoperative due to a broken thrust bearing. This pump's discharge valve was in a closed position and its release line, which emptied into the measuring tanks, had two manually operated valves both of which were open.

6. At approximately 1810, the Halliburton operator, using pump No. 1, began pumping mud to the wellhead. His helper and the Noble pump operator were in the pumproom with him. When the mud line pressure was built up to 5,000 psi, the "Christmas Tree" was opened permitting the mud and the gas from the well to meet. After about 2 barrels of mud were forced into the system, mud began to blow violently from the open measuring tank that was not in immediate use. Suspecting that gas was blowing from the measuring tank and not knowing how it was escaping, the operator idled his pump and left the pumproom in order to telephone the platform and was followed by his assistant. The Noble operator shut his pump off and started to leave the pumproom when the explosion occurred. The valve on the "Christmas Tree" was closed at about the same time.

7. According to the Noble operator, the explosion, a loud booming report, seemed to occur at the Halliburton unit. Unassisted, he made his way to the main deck after the explosion. The Halliburton helper had just stepped on the main deck at the time of the explosion, and saw the pumproom hatch being blown off. A flash followed by flames erupted from the open hatch and black smoke poured out of the galley doors at the after end of the deckhouse. The fire was brought under control at approximately 2000. Examination after the casualty disclosed that flame or fire damages were mainly confined to the pumproom and

machinery spaces, dry storage and reefer area, and crew's quarters on the 2nd deck. Smoke damage extended to living spaces around and above the fire area. Flame damage in the pumproom had apparently been most intense in the area of the Halliburton unit, but the dry storage area, which contained many combustible items appeared to suffer the greatest damage. The watertight door opening into the pumproom from the dry storage and reefer area was bulged forward into the pumproom.

8. The body of the deceased oiler was located on the reefer flat after the explosion. Injuries were sustained by the Noble operator and seven others who were in the vicinity of the deckhouse at the time. One of these men jumped overboard and was later recovered.

9. After the casualty, an investigation by personnel on the vessel revealed that the discharge valve on the inoperative pump, although closed, had a scored or cutout seat.

REMARKS

1. Concurring with the Board, it is considered that the explosion was due to a large amount of gas from the well passing through the faulty discharge valve on the inoperative Halliburton pump, then through the release line of the same pump, then into the pumproom through the mud measuring tank, and from the pumproom into adjoining spaces. Although the source of ignition was not determined, there were numerous possibilities, such as electrical equipment in any of the gas contaminated spaces, or even the lighting of a cigarette.

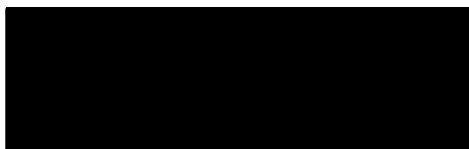
2. As further concluded by the Board, it would appear that the release of the gas might have been prevented if the Halliburton unit had been operated differently and if, for example, either or both valves on the release line of the inoperative pump had been closed. In addition, it would appear that an adequate check valve in the mud line might have prevented this casualty. In any event, however, the cause is considered to have occurred strictly within the scope of the specialized, oil well equipment operation.

3. This casualty supports the desirability of isolating the pumproom, to the extent practicable, from living, working, and machinery spaces. Watertight closures to the pumproom spaces should always be closed when the vessel is connected by piping to an oil or gas well. The master's responsibility for the safety of his vessel dictates that he keep himself informed of any operation which may affect the safety of his vessel so that he may take all reasonable and timely precautions to safeguard the vessel and those on board.

Since the possibility of gases backing up into the pumproom is always present, despite precautions, efforts should also be made to guard against or minimize all sources of ignition within the pumproom. Unless such precautions are taken, isolating the pumproom will not prevent a repetition of this or a similar accident.

4. The Board's conclusion that the system of ventilation provided in the pumproom space was inadequate is concurred in. The presently installed system would not prevent the collection of vapors in the lower layers of the compartment. Although it is recognized that this deficiency cannot be considered as contributing to this casualty (because of the high rate at which the gas escaped), the Board's recommendation concerning an adequate ventilating system is approved.

5. Subject to the foregoing remarks, the record of the Marine Board of Investigation is approved.



J. A. HIRSHFIELD
Vice Admiral, U. S. Coast Guard
Acting Commandant

UNITED STATES COAST GUARD

ADDRESS REPLY TO:

Commander
Eighth CG District
New Orleans, La.



20 December 1960

From: Marine Board of Investigation
To: Commandant (MVI)
Via: Commander, Eighth Coast Guard District

Subj: M/V S-21; explosion and fire, with loss of life; 21 September 1960

Findings of Fact:

1. At about 1822 CST on 21 September 1960, an explosion, followed by fire, occurred on the M/V S-21 resulting in loss of life of one person and injury to eight others.
2. Property damage is estimated at \$12,500.00. Structural damage to the S-21 was negligible.
3. The deceased, John L. Hinds, Jr., of [REDACTED] was employed as an oiler aboard the S-21. The injured and their employers are:

[REDACTED]

The California Co.
The California Co.
Noble Drilling Corp.
Schlumberger Well Surveying Corp.
Schlumberger Well Surveying Corp.
Halliburton Co.
Service Contracting, Inc.
Universal Services, Inc.

4. The S-21 is an LST-type vessel (ex-LST-769) 315' x 50.1' x 24.6', O. N. 257011, gross tonnage 3549, net tonnage 3165, converted for use as an off-shore drill tender, owned by The California Company, New Orleans, Louisiana.

5. At the time of the casualty, in addition to serving as a drill tender, the S-21 also provided quarters and messing facilities for approximately 42 oil workers in addition to the crew of 11. A certificate of inspection expiring 16 January 1961, requires a crew of 9, allows 5 other persons in the crew and, while engaged in oil industry operations, allows a total of 74 oil workers to be quartered aboard the vessel. In addition, various items of oilfield equipment are located on and in the S-21 and other vessels of this type and service.

6. Weather conditions played no part in this casualty.
7. At the time of the casualty, the S-21 was moored bow to a drilling platform or structure designated as California Co. 7-X and located in Block 26, Grand Isle Area. Location of this structure is 29°07'18" North, 90°03'12" West.
8. Prior to the casualty, an operation was in progress involving the cementing or "killing" of a gas well at the foregoing location, preparatory to perforating the casing at a higher level. The equipment in use for this purpose was owned and operated by the Halliburton Co. and was located in the pump room of the S-21, which is located on the third deck in the after half of the vessel. Maximum anticipated well pressure was 4200 to 4500 pounds PSI.
9. Prior to the above operation, the equipment and piping to be used to pump the mud against the well pressure was hydrostatically tested to 6000 pounds PSI. This test was not satisfactory and it was assumed that a small leak previously observed in a joint in the mud line between the S-21 and the structure was responsible for the failure of the test.
10. The Halliburton unit used to pump mud to the well consisted of two positive displacement type pumps each driven by a Diesel engine. Suction is taken from either of two measuring tanks on the unit. Each pump discharge passes through a manually-operated valve, then joins the other pump discharge line at a "T" or "Y" connection, then proceeds to the bow of the S-21 and then to the structure. Between the junction of the two discharge lines and the "Christmas Tree" on the well itself there are no valves. Between each pump and the valve on its discharge line is a release line leading to the measuring tanks. Each release line is fitted with two manually-operated valves.
11. At the time of the casualty, one of the Halliburton pumps was not operative due to a faulty thrust bearing in the engine driving the pump. The valve on the discharge line of the inoperative pump was in a closed position, however, the two valves on the release line were in open positions. Mud was being supplied to the measuring tanks by a pumping unit owned and operated by Noble Drilling Corp.. The Noble pump was taking its suction from the mud tanks of the S-21, located at the forward end of the pump room.
12. According to the operator in charge of the Halliburton unit, [REDACTED], he began pumping mud at approximately 1810 CST. At this time the valve on the Christmas Tree was closed. Approximately 15 minutes later, the mud pressure had built up to 5000 pounds PSI on the Halliburton gauge. The valve on the Christmas Tree was then opened and the Halliburton operator noted that the pressure dropped to about 4200, built up to 4800 and then broke back to 4500 which indicated to him that the formation was taking the mud.

He stated that thereafter he noticed no pressure lower than 4500 on his gauge. About four or five minutes passed when mud began blowing up from the measuring tank of the inoperative pump. The Halliburton operator thought it was due to gas coming back but was not sure through which line it was coming. His reaction was to idle the pump engine to prevent damage to the Halliburton system and mud line when the valve on the Christmas Tree was closed and leave the compartment for the purpose of telephoning the petroleum engineer at the well to close the valve. The Halliburton helper, Arnold J. King, also left the pump room shortly thereafter and had just reached the main deck when the explosion occurred. He saw one of the hatch covers blown into the air and was thrown about ten feet.

13. The Noble operator, [REDACTED], was attempting to leave the pump room at the time the explosion occurred. He made for the ladder at the forward end of the compartment but had not reached the ladder when the blast occurred. Although the most badly burned of all the injured, he was able to climb the ladder to the main deck. He was the only person in the pump room at the time of the explosion.

14. According to the California Co. petroleum engineer, [REDACTED] on the platform, when the mud pressure had built up to 5000 pounds, he told a roughneck on the floor to open the valve to the well. The pressure dropped to 4500 and then built up to 4800 where it remained. This was considered normal and to his knowledge the pressure remained at 4800 until he was called from the S-21 by the California Co. supervising engineer, [REDACTED] and told to shut in the well. About the time the valve was closed the explosion occurred.

15. The deceased, John L. Hinds, Jr., was found on the reefer flat, a space immediately aft of the pump room after bulkhead. On the starboard side of the reefer flat are the chill boxes and the freezer for storage of perishable foods. On the port side is a dry storeroom separated from the reefer flat by a partition and door constructed of a metal mesh. Connecting the dry storeroom and the pump room was a watertight door in the pump room after bulkhead which was dogged and locked at the time of the explosion. After the explosion, this door was found to be distorted by a force which appeared to exert its pressure in a forward direction, or from the dry storeroom to the pump room.

16. Although the area of the reefer flat was not connected by open passages to the pump room on the level of the third deck, it was indirectly open to a circulation of air from the pump room via spaces on the next level below, the boiler room and workshop, located in the vessel's bottom. All the foregoing spaces showed evidence of fire damage.

17. The fire was brought under control at approximately 2000 CST, 21 September, 1960. Afterwards, an investigation to determine the source of entry of the gas was made and, according to [REDACTED] the valve on the discharge line of the inoperative Halliburton pump, although found in a closed position, was found to have a scored or cut-out seat. Both valves on the release line of the inoperative pump were found to be in open positions.

18. The Halliburton and Noble pumping units are not items of inspected equipment.

The Board is of the opinion:

1. That this explosion was due to a large amount of gas from the well passing through the faulty valve on the discharge line of the inoperative Halliburton pump, then through the release line of the same pump (both valves on which were open), then into the pump room through the mud measuring tank on the Halliburton unit itself. The gas then spread to the boiler room, machine shop, dry storeroom and reefer flat through watertight doors and hatches which were left open connecting those spaces.
2. That the source of ignition of the blast cannot be accurately determined. The distortion of the watertight door connecting the dry storeroom and the pump room indicates that the blast may have been triggered in the area of the reefer flat or below, however, this condition could also have been due to the fact that the area of the reefer flat is a more confined space than the pump room itself, which is below a large partially-open cargo hatch.
3. That this casualty was not due to negligence on the part of any licensed or certificated personnel nor was it due to the failure of any inspected material.
4. That the actions of the actionable personnel of the S-21 and the oil workers on board in fighting the fire and confining the damage were very quick and efficient.
5. That the ventilation system in the pump room of the S-21 is inadequate.
6. That an adequate check valve located in the mud line on the bow of the S-21 prior to its entry into the vessel would have prevented this casualty.
7. That, had either or both of the valves on the release line of the inoperative Halliburton pump been closed, the casualty would not have occurred.
8. That the manner in which the Halliburton unit was operated and the actions of the operator in charge of the unit leave much to be desired from the standpoint of safety to the vessel and the personnel aboard.

The Board recommends:

1. That an adequate ventilating system of sufficient capacity be installed aboard the S-21 and all other vessels of a similar type and service to serve the pump room area and that particular attention be given to the removal of heavier-than-air vapor in the area of the mud pits and the mud pumps fitted with open mud tanks.
2. That the mud line and any other line designed to be connected to a gas or oil well from the S-21 and all other vessels of similar type and service be fitted with an adequate check valve at the bow of the vessel prior to entry into the vessel itself.
3. That steps be taken as soon as possible to isolate the pump room of the S-21 and all other vessels of similar type and service from all living, working and machinery spaces. Watertight doors and hatches connecting these spaces should be required to be closed at any time the vessel is connected by piping to an oil or gas well.
4. That in all future conversions of similarly-constructed vessels, the pump room containing the pumps and the mud pits be required to be so located as to isolate this space from living, working and machinery spaces.

[REDACTED]
JOHN F. KETTLER
CAPTAIN, USCG
CHAIRMAN

[REDACTED]
GEORGE J. BODIE
COMMANDER, USCG
MEMBER

[REDACTED]
NORMAN P. WEINERT
LIEUTENANT COMMANDER, USCG
MEMBER AND RECORDER