

MVI

14 August, 1951

(CECILIA - a-7 Bd)

From: Chief, Merchant Vessel Inspection Division
To: Commandant
Via: Chief, Office of Merchant Marine Safety

Subj: Marine Board of Investigation; Tug SS CECILIA, boiler explosion
Charleston, S. C., 18 November, 1950, with loss of life

1. Pursuant to the provisions of Title 46 C.F.R. Part 136, the record of the Marine Board convened to investigate subject casualty, together with its Findings of Fact, Conclusions and Recommendations, has been reviewed and is forwarded herewith.
2. The steam tug CECILIA, built in 1882 of 98 g.t. was engaged in docking the British freighter EASTERN PRINCE at North Charleston, S.C. on the evening of 18 November, 1950. At or about 2245 on this date, the port corrugated furnace in her scotch boiler collapsed causing two separate fractures in the horse collar of the furnace, allowing the water and steam to escape in an explosion. The Chief Engineer and Fireman lost their lives as a result of this casualty.
3. The Board made the following Findings of Fact:
 - "1. The port corrugated furnace of the tug CECILIA collapsed, which in turn caused two separate fractures to occur in the horse collar at the turn of flange of the furnace.
 - "2. The boiler steam and scalding water was released to the fireside through the fractures in the furnace causing the instant death of Charles Durwood Sweatman and severe injuries to Edward Clifton Myatt, Sr., chief engineer, from which he died.
 - "3. The tug CECILIA, official number 126028, built at Camden, New Jersey, in the year 1882, gross 98 tons, net 49 tons and is owned and operated by the White Stack Towing Corporation of Charleston, South Carolina.

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"4. One Scotch Boiler, length 11'3", diameter 109", material steel, thickness 7/10", T.S. of shell 60,000 lbs. Two Morrison Corrugated Furnaces, boiler built in 1925 by Kingsford Foundry and Machine Works, Oswego, New York, steel by Worth Steel Co., Clearmont, Delaware, common combustion chamber, original thickness of furnaces .375, T.S. of furnaces 15000, calculated W. P. of furnaces 153 lbs. 90-3/4" plain tubes, allowed boiler working pressure 150 lbs. P.S.I. Oil Fuel. Last inspection Charleston, South Carolina, 6 January, 1950, hydrostatic pressure applied to boiler 225 lbs.

"5. On the evening of 18 November, 1950, the tug CECILIA was dispatched to North Charleston to assist in docking the British Freighter EASTERN PRINCE at the port terminal docks. At 2245, the engine of the subject tug was working full speed ahead, the fireman was in front of the boiler in the fireroom and the chief engineer was near the throttle in the engine room.

"6. The Master of the tug and one deck hand were in the wheelhouse. Glancing at the steam gauge on the after bulkhead in the wheelhouse the Master noted the pressure read 95 lbs. At this instant a terrific boiler explosion occurred, filling the fireroom and engine room with live steam.

"7. The Master and deck hand immediately attempted to rescue the engineer and fireman but access below was impossible for a period of 15 minutes due to the live steam which engulfed both the fire and engine room. The chief engineer, though fatally scalded, managed to crawl out of the starboard engine room door immediately after the explosion and collapsed on the outside deck.

"8. Towboat ROBERT H. LOCKWOOD, assisting in the docking of the EASTERN PRINCE, went to the assistance of the CECILIA and brought her alongside of the dock.

"9. The fireman was found dead in the fireroom, his body pinned under the starboard furnace front assembly which had been blown off and landed 6 feet from the boiler. The fireman's body had been severely injured and scalded.

"10. The chief engineer was given emergency treatment and rushed to Roper Hospital, where he died of his injuries on the morning of November 20, 1950.

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"11. An examination of the boiler disclosed the following conditions:

- (a) The port corrugated furnace of the boiler had collapsed completely, blocking off the fireside, the crowns crushed down until contacted by the bottom of the furnace.
- (b) The port furnace horse collar had opened up in two places in the knuckle. The inboard fracture began at a point 21" from the bottom center of the furnace and extended around the circumference a distance of 35". The maximum width of this opening was $3\frac{1}{2}$ ".
- (c) The fracture in the outboard side of the furnace began $3\frac{1}{2}$ " to the starboard of the bottom center line and extended up along the circumference outboard a distance of 26". The maximum width of this crack was $2\frac{1}{2}$ ". The location of the cracks is described as viewed from the back connections.
- (d) Both uptake (commonly called smoke box doors) were extensively damaged. The port door was blown up against the grating above and pushed the grating up three feet. The hinges on the door remained intact. The starboard door was blown completely off the boiler.
- (e) The port furnace front assembly remained intact, but the starboard assembly was blown off, apparently struck the fireman, brought up sharply against the high pressure eccentrics, bending the rods and rolled over and pinned the fireman's body to the floor plates.
- (f) Both port and starboard furnace crowns were free of scale, oil, or grease on the waterside and the furnace metal showed no indication of overheating.
- (g) Neither furnace had extensive pitting or corrosion along the fire line. The metal appeared good in all corrugations, but very poor in the horse collar knuckle, along the circumferential welded area.

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- (h) The fusible plugs were in good condition and the crown sheet did not indicate overheating.
- (i) All boiler through stays and staybolts as far as could be reached were tested and examined and found in good condition.
- (j) A small bulge was noted in the inboard section of the throat sheet, approximately 3" inboard from the port furnace flange.
- (k) The boiler safety valve seal was found broken or the wire wasted away. Valve was immediately released and tested and functioned satisfactorily at 152 lbs.
- (l) The boiler safety valve was not connected to the dry-pipe, therefore the possibility of over-pressure was entirely eliminated.
- (m) The internal feed lines discharged the boiler feed water along the shell on the port and starboard sides and well above and away from the furnace crowns.
- (n) The starboard furnace found down on all corrugations in a dangerous condition, as a pronounced flat area existed along all crowns with the exception of No. 1 and 2 corrugations. Maximum distance found down by tramming was 4-11/16".
- (o) The location of the flats along the crowns of the starboard furnace is identical with the angle of collapse of the port furnace. This angle would be as designated by the letter "D" in the tram charts N.C.G. 836.
- (p) Internally at the bottom of the boiler approximately two buckets of medium loose scale was observed.
- (q) The boiler feed water hot well had only slight traces of oil and grease.

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- (r) There is no record as to whether or not the boiler had been opened up and cleaned internally since the last annual inspection on 6 January, 1950.
- (s) There was no evidence as to whether or not the engineer had made use of his scum and bottom boiler blows.
- (t) The horse collars of both port and starboard furnaces have welding on the horse collar knuckles extending nearly the entire circumference. The records in the Charleston office indicate that the port furnace horse collar was welded on only three separate occasions. Once in 1938 when a crack 8" long was repaired. Once in 1939 when 1" of old weld was removed and re-welded, and once in 1946 when a crack 2" long was welded. The total distance welded in the port furnace horse collar according to the records was 11", which is less than 1/10 of the actual distance welded.

Twice after the annual inspection and before the explosion took place, both furnace horse collars had been welded by an unauthorized welder and without the knowledge or permission of the OCMI, Charleston. Chief Engineer Myatt informed the welder on at least one occasion that he, Sumler, was not supposed to do welding on the boiler, because he was not approved by the Coast Guard, but he was instructed by the chief engineer to go ahead and weld the boiler.
- (u) The waterside of the port furnace horse collar was found to have a heavy grooving crack running circumferentially around the entire furnace as far as could be seen.
- (v) In 1935 the Lockwood Corporation, former owners of the CECILIA, bought two new furnaces for the vessel. The company bought these furnaces to have on hand if needed to replace the existing ones, but the furnaces were never installed.

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(w) Test specimens were cut from the horse collar of the port furnace and a section of the corrugation in the center of the apparent point of collapse. These specimens were submitted to the Bureau of Standards, Washington, D. C., for steel analysis. The Bureau reported that the steel in the furnace was of a good quality firebox steel with the exception of the horse collar, which was in poor condition due to repeated weldings. The weldings were unorthodox in that saddle welds had been used instead of v'ed out welding and a bare wire electrode had been used in several welds."

4. The Board expressed the following Conclusions:

- "1. That the collapse of the port furnace was caused by a progressive flattening and coming down of the furnace crowns over a period of time until a critical condition had been reached and a total collapse of the furnace had occurred.
- "2. The exact length of time that this boiler had been operated with defective flat furnace crowns could not be determined by the evidence.
- "3. That an examination of the boiler immediately after the casualty disclosed the furnaces and crown sheets were free of scale, oil and grease and there was no indication of overheated metal that would cause a rapid coming down of the furnace crowns.
- "4. That the basic metal in the horse collar of the port furnace was defective through repeated and improper welding and the tension exerted on the horse collar by the collapsing furnace had caused two large fractures in the horse collar to occur.
- "5. That the evidence indicates that the fractures in the horse collar of the port furnace would not have developed if the furnace had not collapsed.
- "6. That the water and steam pressure in the boiler had been released through the fractures in the horse collar to the fireside of the port furnace and back connection causing the death of the chief engineer and fireman.

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"7. That the boiler water under 95 lbs. pressure when released through the fractures to approximate atmospheric pressure of 14.7 lbs., immediately flashed into steam and increased the volume and force of the steam pressure in the fire and engine room of the vessel.

"8. That had the metal in the horse collar of the port furnace been in good condition, it is doubtful that the fractures would have occurred, even with the collapse of the furnace.

"9. That repeated welding repairs had been made to the horse collars of both furnaces by an unauthorized welder and without the knowledge of the OCMI or other inspector in the Marine Inspection Office.

"10. That the Bureau of Standards report on the furnace coupons submitted for analysis was that the furnace metal of the port furnace at the center of collapse was of a good grade firebox steel, but the metal in the horse collar at the fractures was poor due to repeated poor methods of welding and the use of a bare red electrode.

"11. That the serious grooving action in both the port and starboard furnace horse collar knuckles could not be readily seen on the water side of the furnaces, due to the construction of the boiler. However, being the welding extended nearly the entire circumference of the horse collar on the fireside of both furnaces, it is reasonable to assume that a diligent inspector and chief engineer would question the safety of a furnace with such a large area of welding, even though no leaks developed under hydrostatic pressure at the annual inspection of the boiler.

"12. Although the Coast Guard Inspector testified that he had made a careful and thorough examination of the boiler during the last inspection previous to the explosion, which was conducted at Charleston, S.C. on 6 January, 1950, the opinion of the Board is that he should have become more suspicious and conducted a more rigid examination due to the circumstances cited in paragraph 11 above.

"13. That a competent chief engineer would have made periodic examinations of the boiler between inspections and would have seen the dangerous flattening and coming down of the furnace crowns and prevented the total collapse of the port furnace.

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"14. That the chief engineer was guilty of negligence and inattention to duty as cited in paragraph 13.

"15. That the chief engineer violated Title 46 C.F.R. 52.01-65, Marine Engineering Regulations in that he failed on at least two occasions to notify the Officer in Charge, Marine Inspection, that repairs were to be made to the boiler of the subject tug.

"16. That the chief engineer violated Title 46 C.F.R. Chapter 57.15-1, Marine Engineering Regulations on at least two occasions by allowing an unqualified welder to weld the horse collars of the furnaces of the subject tug.

"17. That the White Stack Towing Company, owners and operators of the tug CECILIA, violated Title 46 C.F.R. Chapter 57.15-1, Marine Engineering Regulations on at least two occasions by allowing an unqualified welder to weld cracks in the horse collars of the furnaces of the boiler of the subject tug.

"18. That the White Stack Towing Company, owners and operators of the tug CECILIA, violated Title 46 C.F.R. Chapter 52.01-65, Marine Engineering Regulations on at least two occasions, having failed to notify the OCMI before welding repairs were made on the boiler of the subject tug.

"19. Although a witness for the White Stack Towing Company stated for the records that in his opinion the furnace collapse was caused by a furnace gas explosion, the Board after deliberation discarded this theory, based on among other things, the fact that the starboard furnace crowns are down $\frac{1}{4}$ and $\frac{11}{16}$ "', and furnace fronts are amply vented when forced draft fan is shut down."

5. The Board made the following Recommendations:

"1. Inasmuch as the evidence clearly indicates that illegal and improper welding was done on the port furnace horse collar of this vessel and that failure of such welding caused by the collapse of the port furnace resulted in the steam and scalding hot water to escape, which resulted in the death of Edward Clifton Hyatt, Sr., chief engineer and Charles Durwood Sweetman, fireman, it is recommended that the records of this case be referred to the United States Attorney for prosecution against the owners and operators of the White Stack Towing Company, Peoples Building, Charleston, S. C., pursuant to R.S. 5344 18 U.S.C. 461.

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"2. That Commander Henry A. Mildrum (1685) USCG, be admonished for having failed to make a more thorough examination of the port furnace to determine the extent of the grooving in the knuckle of the horse collar. Said admonition to be made a part of his official record.

"3. The following changes are recommended in Title 46 C.F.R., Sub-Chapter F, Section 57.15-1(1):

(a) Circumferential cracks in corrugated furnaces not exceeding a total of 20 inches long in any one corrugation may be repaired by welding, provided cracks over 6 inches in length shall have reinforcement steel straps welded at right angles across the crack. Straps shall not exceed 1 and 1/2 inches wide by 1/2 inch thick.

"4. All oil-fired furnaces shall be provided with an observation port of sufficient size to give the operators a clear view of the fireside of the furnace when it is under fire."

REMARKS

6. Conclusions 17 and 18 of the Board with respect to the violation of 46 C.F.R., 57.15-1 and 52.01-65 are concurred with. In this connection the White Stack Towing Company is to be assessed the civil penalty of \$500.00 for each violation, totalling \$2,000.00 as authorized by the provisions of R.S. 4399, as amended, (46 USC 497).

7. Recommendation 1 of the Board with respect to the transmittal of the record of subject casualty to the United States Attorney General for original prosecution of the owners and operators of the White Stack Towing Company is disapproved. The report of the Board does not state the form of organization of the White Stack Towing Company, whether it is a corporation, partnership, association, etc., nor does the report indicate the executive officer, or other officer, for the time being actually charged with the control and management of the operation, equipment or navigation of the CECILIA at the time subject casualty occurred, against whom criminal proceedings are to be instituted. The criminal statute R.S. 5344 (18 USC 461), cited by the Board was repealed by the Act of Congress approved on 25 June, 1948. A review of the record indicates that the negligence and inattention to duty on the part of the chief engineer in allowing operating conditions to come into being which resulted in the collapse of the port furnace, was the proximate cause of the subject casualty. Since under engineering principles the horse

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collar, even though constructed of approved metal and welding may have fractured as a result of the collapsing of the furnace, the violation of the chief engineer or other personnel of the White Star Towing Company in permitting the horse collar to be welded by an uncertified welder, and their failure to notify the Officer in Charge of Marine Inspection that welding was to be effected, cannot be said to constitute a criminal act.

8. The recommendation of the Board singling out Commander Henry A. Milder, USCG, for admonishment because he happened to be the last marine inspector who inspected the boiler some 11 months prior to its explosion, is not approved. The record indicates that the horse collars of both furnaces had been improperly welded over a considerable period of years. This fact indicates that boiler inspections in the 7th Coast Guard District have been substandard and that all marine inspection personnel concerned with boiler inspections on board the CECILIA and their supervisory personnel, are equally responsible for the condition of the horse collars at the time subject casualty occurred.

9. Recommendations 3 and 4 of the Board with respect to the amendment of the Marine Engineering Regulations applicable to inspected merchant vessels will be referred to the Merchant Marine Council for consideration and appropriate action.

10. Subject to the foregoing remarks, it is recommended that the Findings of Fact, Conclusions and Recommendations of the Marine Board of Investigation be approved.

/s/ P. A. OVENDEN
P. A. OVENDEN
Acting

Ind-1

5 September, 1951

From: Chief, Office of Merchant Marine Safety
To: Commandant

Forwarded, recommending approval.

/s/ H. C. SHEPHEARD
H. C. SHEPHEARD

APPROVED:

14 September, 1951

/s/ MERLIN O'NEILL

MERLIN O'NEILL

Vice Admiral, U. S. Coast Guard -10-
Commandant

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"2. That Commander Henry A. Mildrum (1685) USCG, be admonished for having failed to make a more thorough examination of the port furnace to determine the extent of the grooving in the knuckle of the horse collar. Said admonition to be made a part of his official record.

"3. The following changes are recommended in Title 46 C.F.R., Sub-Chapter F, Section 57.15-1(1):

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"4. All oil-fired furnaces shall be provided with an observation port of sufficient size to give the operators a clear view of the fireside of the furnace when it is under fire."

REMARKS

6. That part of paragraph 4 of the Findings of fact which states that the tensile strength of the corrugated furnace steel is 15,600/psi is disapproved. The figure 15,600 is an empirical quantity used in the calculation of the allowable working pressure for Morison type corrugated furnaces installed in boilers constructed prior to 1 July 1935 and has no direct relationship with the tensile strength of the steel used. The inspection records of the CECILIA establish the fact that the tensile strength of the steel used in the furnaces was 60,000 psi.

7. Conclusions 17 and 18 of the Board with respect to the violation of 46 C.F.R., 57.15-1 and 52.01-65 are concurred with. In this connection the White Stack Towing Company is to be assessed the civil penalty of \$500.00 for each violation, totalling \$2,000.00 as authorized by the provisions of R. S. 4399, as amended, (46 USC 497).

8. Recommendation 1 of the Board with respect to the transmittal of the record of subject casualty to the United States Attorney General for criminal prosecution of the owners and operators of the White Stack Towing Company is disapproved. The report of the Board does not state the form of

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organization of the White Stack Towing Company, whether it is a corporation, partnership, association, etc., nor does the report indicate the executive officer, or other officer, for the time being actually charged with control and management of the operation, equipment or navigation of the CECILIA at the time subject casualty occurred, against whom criminal proceedings are to be instituted. A review of the record indicates that the negligence and inattention to duty on the part of the chief engineer in allowing operating conditions to come into being which resulted in the collapse of the port furnace, was the proximate cause of the subject casualty. Since under engineering principles the horse collar, even though constructed of approved metal and welding may have fractured as a result of the collapsing of the furnace, the violation of the chief engineer or other personnel of the White Stack Towing Company in permitting the horse collar to be welded by an un-certified welder, and their failure to notify the Officer in Charge of Marine Inspection that welding was to be effected, cannot be said to constitute a criminal act.

9. The recommendation of the Board singling out Commander Henry A. Mildrum, USCG, for admonishment because he happened to be the last marine inspector who inspected the boiler some 11 months prior to its explosion, is not approved. The record indicates that the horse collars of both furnaces had been improperly welded over a considerable period of years. This fact indicates that boiler inspections in the 7th Coast Guard District have been substandard and that all marine inspection personnel concerned with boiler inspections on board the CECILIA and their supervisory personnel, are equally responsible for the condition of the horse collars at the time subject casualty occurred.

10. Recommendations 3 and 4 of the Board with respect to the amendment of the Marine Engineering Regulations applicable to inspected merchant vessels will be referred to the Merchant Marine Council for consideration and appropriate action.

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11. Subject to the foregoing remarks, it is recommended that the Findings of Fact, Conclusions and Recommendations of the Marine Board of Investigation be approved.

/s/ P. A. OVENDEN
P. A. OVENDEN
Acting

Ind-1

M
5 September 1951

From: Chief, Office of Merchant Marine Safety
To: Commandant

Forwarded, recommending approval.

/s/ H. C. SHEPHEARD
H. C. SHEPHEARD

APPROVED

14 September, 1951

/s/ MERLIN O'NEILL
MERLIN O'NEILL
Vice Admiral, U. S. Coast Guard
Commandant