

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO. 3606

ERIE RAILROAD COMPANY

IN RE ACCIDENT

NEAR SECAUCUS, N. J., ON

NOVEMBER 8, 1954

Report No. 3606

SUMMARY

Date: November 8, 1954

Railroad: Erie Railroad

Location: Near Secaucus, N. J.

Kind of accident: Fuel explosion in combustion space
in train heating boiler.

Train involved: Passenger

Train number: 119

Locomotive number: D-E unit 1404

Consist: Locomotive unit and 6 passenger
coaches.

Speed: 35 - 40 m. p. h.

Operation: Short turn-around passenger service

Time: 5:29 p. m.

Casualties: 1 injured

Cause: Fuel explosion in combustion space
in steam-generator type train heat-
ing boiler; spark plug electrodes
and outfire relay were not properly
adjusted.

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3606

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION
REPORTS UNDER THE LOCOMOTIVE INSPECTION ACT
OF FEBRUARY 17, 1911, AS AMENDED

ERIE RAILROAD

February 10, 1955

Accident near Secaucus, N. J., on November 8, 1954, caused by
a fuel explosion in combustion space of a train heating
boiler.

REPORT OF THE COMMISSION¹

CLARKE, Commissioner:

On November 8, 1954, about 5:29 p.m., near Secaucus, N. J.,
a fuel explosion occurred in combustion space of a steam-
generator type train heating boiler on Erie Railroad Diesel-
electric locomotive unit 1404 while the unit was hauling a
passenger train at an estimated speed of 35 to 40 miles per
hour. The fireman was seriously injured.

¹Under authority of section 17 (2) of the Interstate Commerce
Act the above-entitled proceeding was referred by the Commission
to Commissioner Clarke for consideration and disposition.

DESCRIPTION OF ACCIDENT

Erie Railroad Diesel-electric locomotive unit 1404, hauling westbound passenger train No. 119, departed from Jersey City, N. J., at 5:15 p.m., November 8, 1954. When about 2 miles west of Secaucus, N. J., the train heating boiler warning light became illuminated and alarm bell sounded. Shortly thereafter, at about 5:29 p.m., an explosion occurred in the steam generator firepot and combustion passages while the train was moving at an estimated speed of 35 to 40 miles per hour. The metal doors housing the heating boiler controls, gauges, and operating valves were violently forced open by the explosion, struck the fireman and knocked him to the cab deck.

The Vapor-Clarkson steam generator with which the unit was equipped was started about 3:45 p.m. The unit was coupled to the train about 4:20 p.m. and steam was turned into the train heating system. Shortly thereafter dense black smoke emanated from the boiler stack. This condition ceased before departure of the train.

The train consisted of Diesel-electric unit 1404 and 6 coaches. The enginemen were seated in their normal positions in the cab at the time the generator warning devices functioned. The fireman immediately went to the generator control doors in the rear cab wall to shut down the generator. The explosion occurred as he was opening the doors.

The engineer shut off the steam generator without interference to the train movement.

The injured fireman remained on the train until it reached its western terminal, Waldwick, N. J., 24.3 miles from Jersey City, where he received medical treatment.

DESCRIPTION OF LOCOMOTIVE UNIT AND APPURTENANCES

Erie Railroad Diesel-electric locomotive unit 1404 was a 1500 H.P., road switching type B-B, built by the Electro-Motive Division in October 1952. It was equipped with a two-cycle, model 16-567-B, Diesel engine, D-12-B main generator and D-14 alternator, four D-27-B traction motors, and Westinghouse schedule 6-BL air brake equipment and weighed 247,952 pounds with one-half variable supplies. The superstructure was divided into three compartments. The front compartment housed the Diesel engine, main generator, air compressor, and other appurtenances. The middle compartment, the enginemen's cab, was 10 feet wide by 9 feet 4 inches deep and was provided with seats on both sides and the usual control equipment. Four doors were located at the cab back wall. Facing the back wall, the door located on the extreme left led to the right back running board. Adjacent and to the right of this were two metal doors, hinged at

the outer edges, which swung outward and joined at the center. These doors, which covered the steam generator controls, valves, gauges, and other appurtenances, had a combined width of 38½ inches, were 5 feet high, and 3/16 inch thick, and were held closed by two latches at the top and bottom door frames. Adjacent to the right was a door, 20 inches wide by 5 feet 10 inches high, which led to a passageway alongside the steam generator which was housed in the third compartment.

The heating boiler, serial No. 9081, builder's model OK-4625, was the forced circulation, spill-over type, manufactured by the Vapor Heating Corporation in September 1952. It was located approximately 10 inches to the right of the longitudinal center line of the compartment, had an evaporative capacity of 2750 pounds of water per hour and was provided with two safety valves, set at 295 and 300 pounds per square inch, respectively.

In this type of boiler the steam generating portion, which was enclosed in a metal casing, consisted of sets of coiled water tubing, nested and connected in series to form a single tube several hundred feet long. Part of the water pumped into the coil inlet was converted into steam as it progressed through the coils. Fuel oil was sprayed under pressure through an atomizing nozzle into the firepot where the spray was mixed with combustion air supplied by a blower and electrically ignited. The products of combustion flowed down and outward through the nest of coils to the stack.

The supply of fuel was regulated to evaporate 90 to 95 percent of the water pumped through the coils. The steam-water mixture entered a steam separator where the water was removed and the steam passed to the trainline. The excess water collected in the bottom of the steam separator, flowed through a steam trap and thence through a heat exchanger to a supply tank.

The blower, water pump, and fuel pump were motor-driven at constant speed. The steam generator output was automatically controlled by water by-pass regulator which was hand adjusted to the trainline steam pressure desired. At decreased demand the water was by-passed back to the inlet side of the water pump and thus reduced the flow of water to the evaporating coils. When demand increased the amount of water by-passed was reduced and more water was supplied to the coils. Before entering the coils, the water passed through a servo-fuel control which admitted fuel to the atomizing spray nozzle in direct proportion to the amount of feed water flowing through the servo-control to the coils. The servo-fuel control also adjusted the damper in the intake air duct so that the proper amount of air was admitted for efficient combustion of the fuel. Ignition current was supplied to the spark plugs at all times during operation. The motor converter transformed D. C. current into A. C. current which flowed through the ignition transformer where it was stepped up to 12,000 volts and

delivered to the spark plugs. The manufacturer's maintenance instructions specified in part: "The gap between electrodes should be set at exactly 3/16"."

The steam generator was provided with several protective devices among which were a stack switch and an outfire relay. The stack switch was designed to shut down the generator and actuate an alarm in event the exhaust gas temperature exceeded 900 degrees F. or fell below 300 degrees F. The outfire relay was so designed that the steam generator would shut down and warning signals function in the event flame was unintentionally extinguished while the generator was in operation. The outfire relay contactors and stack switch low temperature contactors were connected in parallel in the control circuit; if one or both contactors were closed, the circuit was complete, and if both were open, the circuit was broken. The outfire relay coil was energized and the contactors were closed when the steam generator control was on "Off" or "Fill" position. It was also energized and the contactors were closed when the generator control was on "Run" position and operating on "Off Cycle". A pneumatic time delay feature opened the circuit in 43 to 47 seconds after the relay coil became deenergized. In the event the fire was extinguished during operation, the stack switch low temperature contactors would open, stop the generator, and give a warning signal when the stack temperature fell below 300 degrees F.

Two inspection covers, 12½ inches high and 29½ inches long, and located 15½ inches above the compartment floor, were provided at each side on the periphery of the boiler casing. They were held in place by metal channels and covered openings to the water coils and combustion passage.

EXAMINATION OF LOCOMOTIVE UNIT AND APPURTENANCES

The steam generator on unit 1404 had been repaired and returned to service at time of the investigation.

The right inspection cover had been blown from the steam generator by the explosion. No other damage was found. Unit 1404 was taken to Jersey City, N. J., where the steam generator was examined, tested, and repaired. The spark plug electrodes had a 7/16-inch gap instead of the specified 3/16-inch gap. The outfire relay was found to be out of adjustment and would not drop out as designed.

After these devices had been adjusted and a new fuel spray-head applied, the steam generator was tested and found to operate properly.

INSPECTION AND REPAIR REPORTS

Boiler 9081 received last quarterly inspection at Jersey City, N. J., on September 21, 1954, and was last washed on October 28, 1954.

Daily inspection and repair reports from Avoca, Pa., Port Jervis, N. Y., and Jersey City, N. J., covering the 35 day period immediately prior to the accident were examined. The following items which may have had bearing on the accident were found reported:

- Oct. 5, Jersey City, N. J., 10:00 a.m., reported by inspector: "Nipple on heat exchanger leaks bad at steam generator." Item signed for. Report approved by foreman.
- Oct. 20, Jersey City, N. J., 1:20 a.m., reported by engineer: "Steam generator repaired." Item signed for. Report approved by foreman.
- Oct. 20, Jersey City, N. J., 7:55 a.m., reported by engineer: "Steam generator blow-down examined for air leak when using push button in cab." Item signed for. Report approved by foreman.
- Nov. 3, Jersey City, N. J., 11:30 a.m., reported by engineer: "Steam generator smokes badly, fumes come into cab." Item signed for. "Check stack switch." Item signed for. Report approved by foreman.
- Nov. 5, Jersey City, N. J., 10:30 a.m., reported by engineer: "Steam generator out of order." "Flame keeps going out all the time." (Note on back of report - "Defective bypass regulator".) "No water comes out of test cocks." (Note on back of report - "Water bypass regulator renewed.") Items signed for. Report approved by foreman.

DISCUSSION

The dense black smoke which emanated from the boiler smoke stack, while unit 1404 was standing at the Jersey City station indicated that improper combustion had occurred at that time but the condition corrected itself without attention. Just prior to the explosion the fire went out in the boiler and reignition was

not immediately obtained because of the excessive spark plug electrode gap. The alarm signal was given by function of the stack switch low temperature device when the stack temperature dropped to its setting, but since the outfire relay was out of adjustment, with contacts in, the control circuit was not broken and the generator continued to operate. While in this condition, fuel oil continued to be fed from the fuel sprayhead. This oil contacted hot firepot refractory material, apparently generating oil vapor which later ignited and resulted in the explosion. Successful operation of this type of heating boiler depends upon proper operation of automatic controls and regulatory devices. Improper functioning of fuel oil safety shut off controls and defective ignition equipment are elements of potential accidents. Spaces and passageways adjacent to heating boiler installations on Diesel-electric units are often restricted to an extent that employees cannot escape the flash of a fuel explosion. Where safety is dependent upon automatic controls it is essential that such controls be properly maintained.

CAUSE OF ACCIDENT

It is found that this accident was caused by an oil vapor explosion in a steam generator type of train heating boiler, resulting from excessive spark plug electrode gap and defective outfire relay.

Dated at Washington, D. C., this 10th day
of February, 1955.

By the Commission, Commissioner Clarke.

SEAL

GEORGE W. LAIRD,

Secretary.