INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO. 3520

CHESAPEAKE & OHIO RAILWAY COMPANY

IN RE ACCIDENT

AT HINTON, W. VA., ON

JUNE 9, 1953

Report No. 3520

SUMMARY

Date:	June 9, 1953
Railroad:	Chesapeake & Ohio
Location:	Hinton, W. Va.
Kind of accident:	Boiler explosion
Train involved:	Freight
Train number:	Extra 1642 East
Locomotive number:	1642
Consist:	123 loaded and 2 empty cars
Speed:	20 m. p. h.
Operation:	Freight movement
Track:	Level and tangent
Time:	5:25 p. m.
Casualties:	3 killed
Cause:	Overheated crown sheet resulting from low water

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3520

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

CHESAPEAKE & OHIO RAILWAY

July 6, 1953

Accident (boiler explosion) at Hinton, W. Va., on June 9, 1953, caused by overheated crown sheet due to low water.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner:

On June 9, 1953, about 5:25 p.m., at Hinton, W. Va., the boiler of Chesapeake & Ohio Railway locomotive 1642 exploded while the locomotive was hauling a freight train at an estimated speed of 20 miles per hour. The engineer, fireman, and head brakeman were killed.

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

DESCRIPTION OF ACCIDENT

Chesapeake & Ohio Railway locomotive No. 1642, hauling eastbound freight train Extra 1642 East, departed from Handley, W. Va., at 1:20 p.m., June 9, 1953, and proceeded without any known unusual incident to CW Cabin, near the city limit of Hinton, W. Va., a distance of 71.6 miles from Handley, where, about 5:25 p.m., the boiler of the locomotive exploded while the train was moving at an estimated speed of 20 miles per hour.

The train left Handley, W. Va., with 91 loaded cars, adjusted tonnage 7510 tons. A stop was made at Thurmond, W. Va., 38.6 miles from Handley, at 2:55 p.m., where coal and water were taken, and a stop was made at Quinnimont, W. Va., 12 miles from Thurmond, at 4:12 p.m., where water was taken and cars were picked up. The train departed from Quinnimont, approximately 21 miles from the point of the accident, at 4:38 p.m. with consist of 123 loaded and 2 empty cars, 10,430 adjusted tons. The tonnage rating for the locomotive over this part of the division was 11,500 adjusted tons. Approaching the scene of the accident the track was undulating, but at the point of the explosion was level and tangent. The weather was clear and dry. The positions of the three employees on the locomotive at time of the accident were not known.

At the point of the explosion, there were two tracks on the left side of the eastbound main, the westbound main and a switching lead, and on the right side New River ran approximately parallel with and about 55 feet from the eastbound main.

The force of the explosion tore the boiler from the frame and cylinder connections and it was thrown upward and forward. The boiler struck on its front end on the rails of the eastbound track approximately 440 feet ahead of the point of the explosion, then rebounded. The back head struck the track 639 feet ahead of the point of explosion where the boiler came to rest on its right side in reversed position with front end on the adjacent westbound track and firebox on the switching track. The smoke box front was blown off and several superheater units were blown out. The cab was blown 133 feet to rear and 58 feet to right of the point of explosion where it fell at the water edge of New River. Grates, grate bars, throttle lever, and other parts were scattered for distances up to approximately 772 feet from point of accident, some falling in New River. Many appurtenances were badly damaged and some parts could not be located. The track rails at point of explosion were indented by the trailing truck wheels and

the two rear pairs of driving wheels and the westbound track was moved approximately 5-1/4 feet to the left. At the point where the front end of the boiler struck, the track rails were broken and badly bent and a large hole was torn in the road bed. Where the back head of the boiler struck, the westbound track was moved 3 feet to the left. The locomotive running gear with tender attached came to rest with front end alongside the front end of the boiler with only trailing truck wheels derailed. All tender truck wheels were derailed and the front truck was off center. The tank was skewed to the left with left front corner leaning approximately 10 degrees to the left. Nine cars were derailed and bunched, five were at approximately 90-degree angles with the rails four of which were on their sides.

The engineer, fireman, and head brakeman were killed. The engineer's body was found at the water's edge of New River, approximately 75 feet to rear of the cab. The fireman's body was found in the cab, and the brakeman's body was found in a ditch on the left side of the tracks near the point of the explosion.

DESCRIPTION OF LOCOMOTIVE

Locomotive 1642, 2-6 + 6-6 type, carrier's classification H-8 Alleghany, was built by the Lima Locomotive Works Inc., at Lima, Ohio, in December 1944. The four cylinders were 22-1/2 x 33 inches, the diameter of driving wheels 67 inches with new tires, weight in working order 771,300 pounds, weight on driving wheels 507,900 pounds, and tractive effort 110,200 pounds. The locomotive was equipped with an Alco Type H power reverse gear, American multiple front end throttle, Standard N D stoker, Franklin No. 8-A Butterfly mechanically operated fire door, Baker valve gear, Worthington Type 6-1/2 S S A feed water pump, Nathan Type 4000-C special injector The boiler was equipped with a Nathan Type B low water alarm and there were three Nicholson thermic syphons in the firebox. Locomotive had made 97,000 miles since last Class 3 repairs and 18,000 miles since last Class 5 repairs. The rectangular cast-steel water-bottom tender had capacity of 25,000 gallons of water and 25 tons of coal.

The boiler was of the three-course conical type with combustion chamber and wide radial-stayed firebox; builder's serial boiler number 8811. The inside diameter of the first course was 101-1/8 inches, second course 103-11/16 inches, and third course 106-5/16 inches; thickness of first course 1-9/32 inches, second course 1-5/16 inches, and third course 1-11/32 inches. The

boiler had 48 2-1/4 inch outside diamter flues and 278 3-1/2 inch outside diameter flues, 23 feet in length, and 71 Elesco Type E superheater units. The working steam pressure of the boiler was 260 pounds per square inch.

The radial-stayed firebox was 180 inches long and 109 inches wide, and combustion chamber was 118 inches long. The firebox consisted of a one-piece crown and upper side sheets, lower one-fourth side sheets, door sheet, flue sheet, and inside throat sheet. Flue sheet and throat sheet were 9/16 inch thick and other sheets were 3/8 inch thick. Flue sheet seam was riveted and door sheet seam was riveted across the top and welded down the sides. Other seams and patches in the firebox were butt welded. The crown sheet was 11-3/4 inches higher at the flue sheet than at the door sheet. The firebox was fitted with three thermic syphons. There was no syphon in the combustion chamber. New flue sheet and lower side sheets were applied on April 6, 1950, at which time a patch was applied in bottom of combustion chamber, one-half section applied to left syphon, and patches applied to center syphon and to diaphragm of connection sheet. Crown stays were 1-1/8 inch diameter reduced body type, spaced approximately 4-1/16 x 4 inches. Combustion chamber stays were 1 inch diameter, spaced approximately 4-1/6 x 4 inches. Firebox stays were 1 inch diameter, spaced approximately 4-1/8 x 4 inches. All stays were rigid except in the combustion chamber and breaking zones.

EXAMINATION OF BOILER AND APPURTENANCES

BOILER

The crown sheet had been overheated its entire width at flue sheet, the overheated area extending to the 12th row of stays on each side of longitudinal center at front end and tapering gradually upward and backward to the 1st row of stays on right and left sides of center syphon at the 57th transverse row. The line of demarcation was distinct and indicated the water had been approximately 7-1/4 inches below the highest part of the crown sheet. Crown sheet had evidently initially pulled from 123 stays and pocketed at the front center. The stays in this pocketed area were a deep blue in color, stay ends were cupped to a maximum depth of 1/4 inch, and stay holes were elongated to a maximum diameter of 1-3/4 inches. The sheet was not thinned to any noticeable extent.

The back flue sheet tore through the top row of flues from the flue sheet flange at 11th row of crown stays on right side to the 13th row on left side. The tear continued into the sides of combustion chamber, terminating in vicinity of the 20th longitudinal row and 5th transverse row of stays on each side. The top part of flue sheet below the tear was pulled from 41 flues and folded down. The crown sheet and side sheets above tears in the combustion chamber were blown down against the bottom of combustion chamber, the folds on each side starting at the ends of the tears in sides of combustion chamber sheet.

Irregular tears practically crossed the crown sheet between the 24th and 28th transverse rows of stays and extended down in the side sheets to about the 20th longitudinal rows of stays on each side. Other irregular tears crossed crown sheet at about the 39th transverse row of stays and extended down in side sheets to about the 20th longitudinal row of stays on each side. Irregular longitudinal tears joined the ends of these transverse tears in the side sheets. The rear row of tears across crown sheet were just ahead of the thermic syphons. A large part of the torn out portion of crown sheet folded down over the throat sheet and left syphon. The three syphons were pulled out of inner throat sheet; were badly bent and center syphon was broken through more than 50 percent of its cross-sectional area at the neck.

The crown sheet was pulled from approximately 861 stays. A total of 1587 stays were pulled from the crown sheet, combustion chamber, and side sheets. Threads on crown stays and in stay holes appeared to have been in good condition prior to the accident. There were no broken crown stays or staybolts in firebox sheets. No crown stays or staybolts showed any indication of having been worked excessively, and all flue ends appeared to have been in good condition previous to the accident. There was a slight amount of scale on the sheets.

The back head and the roof sheet and door sheet were dented when the boiler struck the track rails. Both sides of the mud ring were sprung outward 13 inches at the center.

APPURTENANCES

Safety valves: The boiler was equipped with four 3-1/2 inch Consolidated safety valves, three open and one muffled type, located on top of the third course. Safety valves were not badly damaged in the accident, but the right safety valve nipple was partially pulled from the boiler. The safety valves were

applied to locomotive 1636, same class as locomotive 1642, and each valve tested twice. A test gage was mounted adjacent to the safety valves and a certified gage was used in the cab. On both trials, No. 1 valve opened at 255 lbs. and closed at 252 lbs., No. 2 valve opened at 260 lbs. and closed at 252 lbs., No. 3 valve opened at 262 lbs. and closed at 256 lbs., and No. 4 valve opened at 266 lbs. and closed at 256 lbs. The No. 4 valve simmered at 262 lbs. and opened fully at 266 lbs.

Steam gage: An Ashcroft 400-pound 6-inch double-dial steam gage which had been mounted at center of boiler back head was not recovered. Steam gage valve and siphon pipe were found broken and twisted.

Water level indicating devices: The boiler was equipped with a Nathan 300-pound water column, located 29-1/2 inches to the right of vertical center line of boiler back head. Three gage cocks and a 6-1/2 inch reflex water glass were applied to the column. An additional reflex water glass was mounted on the left side of the boiler back head 36 inches left of back head vertical center line. The water column, both water glasses and all water-glass valves, and gage cocks were made by Nathan Manufacturing Company.

All water level indicating device connections to the boiler were broken off or torn out by impact.

The bottom connection between water column and boiler was located 16 inches above the horizontal center line of the back head. A 1-1/2 inch O. D. copper pipe extended from the top of the water column to a company's standard spud which was located 12 inches ahead of wrapper sheet calking edge and 6 inches to right of the top center line. The bottom water-column spud which extended into the water space 4 inches was crushed, but its 3/4-inch opening appeared to be unobstructed. The top column steam pipe was destroyed and the wrapper sheet spud broken off. The 1-1/4 inch opening in the spud was found clean and unobstructed. The interior of the water column was free from scale and mud deposits; the 3/4-inch drain valve was torn off but was found in closed position and operated freely when tested.

Three double-seated gage cocks were spirally mounted on the water column with 3-inch differences in height. The gage cocks which were broken off and damaged, could not be tested under pressure. The 5/16-inch openings into the column were unobstructed. Visual inspection of component parts when disassembled showed no evidence of leakage or abuse. Carrier's

records showed the lowest gage-cock opening had been 6-1/2 inches above the highest part of the crown sheet and level with the lowest reading of the water glasses.

Right water-glass valve connections were broken off flush with the water column, leaving clean 3/8-inch holes. The 5/8-inch O. D. copper steam pipe connecting the right water glass to the water-glass valve was found in good condition.

The left reflex water glass was mounted 26 inches to the left of vertical center line of boiler back head with the bottom connection 25 inches above the horizontal center line. A 5/8-inch O. D. copper steam pipe connected the water glass to a company's standard spud which entered the boiler 6 inches to the left of center line and 12-1/2 inches ahead of the wrapper sheet calking edge. The bottom connection to the left water glass had been broken off. The bottom spud extended 3 inches into the water space and its passageway was unobstructed. The left top water-glass steam pipe and spud were not recovered.

The right and left top and bottom water-glass stop valves were found in fully opened position. The 3/8-inch valve openings were unobstructed. The threads on both water-glass bodies were damaged, but the unbroken reflex glasses showed a clear water line at all heights when tested with cold water. The drain valves from these valves were not recovered.

Injector: The Nathan Type 4000-C injector, which had capacity of 13,000 gallons per hour, remained attached to the right side of the main frame. Its steam pipe, delivery pipe, starting lever, and extension to overflow valve were torn off and the injector was found in badly damaged condition. Four company officials stated that the steam valve and regulating valve were found in closed position. A new overflow valve stem was applied in order that tests could be conducted on locomotive 1636. During a two-minute test with boiler pressure at 205 pounds, the water was raised 1-3/4 inches. The pressure was raised to 255 pounds; the level of water lowered to conform with original height, and approximately identical performance was obtained in a second two-minute test. Starting when the 266-pound safety valve lifted, the injector was tested at various stages of descending boiler pressure. These tests demonstrated the injector functioned properly until the steam pressure had fallen to 120 pounds.

The carrier's drawings showed the starting lever for the non-lifting injector was of the latched lever and quadrant type, and secured to the floor at the left side of engineer's seat box, 24 inches ahead of the back wall of the cab.

Feed water pumps: The boiler was equipped with a Worthington Type 6-1/2 S S A feedwater pump, 14,400 gallons per hour capacity. The turbine-driven cold water pump with attached feed water hose was broken from the bracket at the left rear main frame extension. The strainer and its compartment were clean and the strainer was found in proper position. The pump could not be tested because of the damaged condition of the impeller housing and water discharge fitting. The governor steam control valve was removed from the cold water pump and tested on locomotive 1610 in the condition as found. Results of the tests indicated this control valve functioned practically identically with the original equipment of locomotive 1610.

The feedwater heater was so badly damaged that any previous leakage from the system and its related piping could not be determined. The drifting control steam valve was dismantled and its spring and valve were found in good condition.

The hot water pump was broken through the center member and the piston rod was bent approximately 20 degrees. All parts of the steam portion of this pump, including reversing valve, were well lubricated and worked freely; packing ring and valve ring fit and pressure against the cylinder walls were good. The hot water portion of this pump was also found in good condition. All twelve wing-type valves were found seated and valve springs had good resilience. Valves had good contact with the seats. There were no foreign objects found in the cylinders or pump passages.

The manifold steam valve and piping, with throttle valve attached had been separated from the manifold. The manifold valve was found in open position. The 1-1/2 inch 300-pound Lukenheimer throttle valve was found completely closed with threaded valve stem bent.

The hot and cold water pumps, drifting control valve and governor control valves were disconnected after the accident and examined. Visual inspection did not indicate any defective conditions.

Boiler checks and delivery pipes: The 3-1/2 inch delivery pipes were badly damaged but the check valves and stop valves remained attached to the boiler. The stop valves were found in open position and were clean. The 3-inch right boiler check valve, located on the first boiler course, operated freely and had 1/16 inch lift in excess of the carrier's standard. This valve body had a small deposit of soft scale. The valve and its

seat were in good condition. A corresponding check valve, located above the center line on the left side of the first course had lift 5/32 inch in excess of the carrier's standard and was found clean. The valve and its seat were in good condition and the valve was free.

Blow-off cocks: The boiler was fitted with four 2-inch Okadee blow-off cocks located near the mud ring corners. The two front blow-off cocks were piped to a blow-down separator located on top of the boiler and manually operated from the right and left sides of the cab. The right back blow-off cock was torn off and its valve was found seated and could not be operated manually. The other three cocks remained attached, but due to damage of the operating mechanisms, the former valve positions could not be determined.

Low water alarm: The exterior parts of the Nathan Type B low water alarm which had been located on the third course of the boiler were damaged and the interior drop pipe was twisted from normal position. The cab alarm whistle and pipe were found crushed against the boiler back head. Carrier's records, dated March 29, 1950, indicated that the water level at which the alarm would function was 6-3/4 inches above the highest point of the crown sheet.

Feedwater tank, tank valves, hose and strainers: The feedwater tank valves were found fully open, and the 4-1/2 inch feedwater hose remained attached to the right side. The 8-inch circular copper strainer in the feedwater line to the injector was not found. The left hose was found with the cold feedwater pump. Both tank hose were in good condition. There was between 3/4 and 1 inch of scale and rust flakes in the bottom of the tank which could have been dislodged by shock at time of the explosion. The carrier's standard water level gage was observed by first witnesses and showed water at the second opening approximately 21 inches from the bottom of the tank.

Boiler water condition: Records of boiler water hardness on file at Hinton, W. Va., for June 8, 1953, showed 90 grains inbound and 85 grains outbound. On arrival at Handley, W. Va., on June 9, 1953, the hardness was shown at 70 grains, and when last dispatched from Handley the reading was 50 grains.

INSPECTION AND REPAIR REPORTS

The last annual inspection was made at Clifton Forge, Va., on July 25, 1952. The last monthly inspection was made at

Hinton, W. Va., on June 5, 1953. The locomotive was out of service for the months of February, March, April, and May, 1953, and was returned to service on June 5, 1953. Daily inspection and repair reports since that date, from all points from which the locomotive had been operated, were examined and the following items which might have any bearing on the accident were found reported:

June 5, Engineer reported: Water pump not working, clean governor.
Item signed for and report approved.

June 5, Machinist reported: Clean cold water pump governor.
Item signed for and report approved.

June 5, Engineer reported: Water pump quits working, clean and examine governor.
Report approved.

June 7, Engineer reported: Water pump stopped 3 or 4 times.
Item signed: Tested OK. Report approved.

June 8, Engineer reported: Water pump wont work, renew governor in cold water pump.
Item signed: Tested 1-1/4# per min.
Report approved.

At all terminals on the Chesapeake & Ohio Railway, the feedwater pumps and low water alarms are tested outbound. On June 9, at 11:30 a.m., at Handley, W. Va., a machinist filled out the prescribed form showing these tests had been made.

SUMMARY OF EVIDENCE

The engineer who operated locomotive 1642 on its next to last previous trip and who was the last engineer to handle the locomotive on the road prior to the engineer who was killed in the accident stated that nothing unusual occurred on that trip and that the feedwater pump and injector operated satisfactorily. His fireman on that trip also stated that no trouble was experienced during the trip; that he operated the water pump without difficulty; that the injector was also used and functioned properly.

The foreman at Thurmond, W. Va., stated that when the locomotive took coal at that point on the trip on which the accident occurred the engineer asked him to look at the cold water pump governor and see if it was stuck; it was examined, found free, and put back in. He then went with the engineer into the cab to examine the squirt hose which operated from the cold water line, the cab was washed down, and the locomotive was put back on the train.

A machinist at Handley, W. Va., the point from which the locomotive was last dispatched, stated that he tested the water pump and it raised the water level line 1-1/4 inches per minute and that he did not find anything wrong with the pump.

A machinist helper, who was between 150 and 175 feet from the track and approximately 1-1/2 miles from the point of the explosion, stated that when the locomotive passed by him the engineer was seated in his usual position in the cab; the fireman was in a bent position on the left of the engineer; that the low water alarm whistle was sounding, and the exhaust from the stack sounded as if the engineer was working a medium throttle.

A roundhouse foreman and a sheet metal worker stated that they arrived at the scene of the accident about 5:30 p.m. and saw water running from the left tank hose which had been severed; that it continued to run until about 6:10 p.m., and that no water was coming from the injector overflow.

The telegraph operator on duty at CW Cabin at the time of the accident stated that he received a telephone inquiry concerning location of Extra 1642 East; he looked down the track and saw the train approaching from a distance of about 600 feet; he arose and as he again looked at the approaching train the explosion occurred. He stated the locomotive appeared to disintegrate, then was obscured by steam and smoke. After parts of the locomotive stopped falling, he called the train dispatcher and reported that locomotive 1642 had blown up and was wrecked in front of the office and requested that an ambulance be called. He further stated that he noted nothing unusual when he first observed the train approaching and that the locomotive sounded as though the engineer was working a medium throttle.

CAUSE OF ACCIDENT

It is found that this accident was caused by an overheated crown sheet due to low water.

Dated at Washington, D. C., this 6th day of July, 1953.

By the Commission, Commissioner Patterson.

SEAL

GEORGE W. LAIRD,

Acting Secretary.