National Transportation Safety Board

Railroad Accident Brief

Union Pacific Railroad Derailment with Hazardous Materials Release and Subsequent Fire

Fort Worth, Texas

April 24, 2019

The Accident

On April 24, 2019, at 12:33 a.m. local time, a southbound Union Pacific Railroad (UP) high-hazard flammable key train, UEBLTG20, carrying denatured ethanol (UN1987), derailed in Fort Worth, Texas.[1] (See figure 1.) The train was 6,122 feet long, weighed 13,230 tons and consisted of three locomotives, two buffer cars, and 96 loaded tank cars.[2] Twenty-six tank cars derailed and three tank cars were breached, leaking 65,270 gallons of denatured ethanol.[3] Several cars caught fire. The released denatured ethanol ignited and formed pool fires and some product entered a tributary of the Trinity River. The train was traveling 26 mph and it was raining at the time of the derailment. UP estimated the damages to be $6,313,217.[4]

[1] (a) All times in this document are local time unless otherwise noted. (b) The Association of American Railroads (AAR) defines "*key train*" as any train with: One tank carload of Poison or Toxic Inhalation Hazard (PIH or TIH) (Hazard Zone A, B, C, or D), anhydrous ammonia (UN1005), or ammonia solutions (UN3318); or 20 car loads or intermodal portable tank loads of any combination of hazardous material, or; one or more car loads of Spent Nuclear Fuel (SNF), High Level Radioactive Waste (HLRW). *Key trains* are subject to speed restrictions and other special operating criteria. (c) *Denatured ethanol* is a highly flammable mixture of ethanol and natural gasoline.

[2] *Buffer cars* are nonplacarded cars that are used to separate locomotives from hazardous materials freight cars. The requirements for positioning in trains of placarded cars are provided in Title 49 *Code of Federal Regulations* 174.85.

[3] (a) Twenty-five of the twenty-six derailed tank cars sustained damage.

[4] Additional information can be found in the public docket for this NTSB accident investigation (accident number RRD19FR007) by accessing the NTSB Accident Dockets Link at www.ntsb.gov.

Figure 1. Aerial view of derailed UP train UEBLTG20.

The derailment occurred near milepost 48.8, on UP's Midlothian Subdivision, where the single main track transitioned from a left-hand curve to a right-hand curve ("S" or reverse curve), with a short segment of tangent track between the two curve segments. This single main track runs next to Echo Lake and a recreational park that surrounds the lake. The lake lies to the west side of the track structure and is used to retain rain runoff from street and culvert drains, as well as recreation.

A significant amount of rainfall had occurred in the area over a period of several days prior to the accident. The UP Harriman Dispatching Center had not issued special instructions or bulletins related to adverse weather or flooding to the train crew.[5]

The train crew told National Transportation Safety Board (NTSB) investigators during interviews that at the time of the accident, the lake was full of water, and that water was pooling near the tracks and over the rails. Soon after going through the S curve, the train's emergency brakes applied bringing the train to a stop.[6] When the train crew looked toward the rear of the train, they saw that several cars in the train were on fire. The train crew developed a plan to separate and move the three locomotives and 16 uninvolved tank cars, including two buffer cars, away from the tank cars on fire. They called the UP Harriman Dispatching Center, who notified emergency responders. After moving the cars, the train crew awaited the arrival of emergency responders. There were no injuries caused by the derailment. The police evacuated six to ten nearby homes, although some residents did not choose to evacuate.

[5] The *UP Harriman Dispatching Center* is the dispatching center for the UP Railroad located in Omaha, Nebraska. It is operated 24/7.

[6] According to the locomotive data recorder provided to investigators by UP, the emergency brake application occurred at about 12:33 a.m. This application was not applied by the train crew.

Before the Accident

The train crew went on duty at 10:30 p.m. on April 23 at Ney Yard. The crew completed a job safety briefing at the start of their shift and reviewed operating bulletins and special instructions.

The weather observations from Fort Worth Meacham International Airport reported that 1.80 inches of precipitation fell on April 13, 0.87 inches of precipitation combined fell on April 17 and 18, and a total of 6.75 inches of precipitation fell in April 2019.[7] The Midwestern Regional Climate Center "TX03" area, which included Tarrant County and Dallas County, to which Tarrant County and the accident site are all apart, had the 14th wettest April in the last 125 years covering from 1895 to 2019 with 205 percent of normal precipitation for April 2019.

During interviews with NTSB investigators, the manager of track maintenance responsible for the Midlothian Subdivision described Echo Lake's flooding history and its effect on the tracks. UP's engineering department also provided a "Highwater Events Report" showing the following flooding history of Echo Lake along this portion of the Midlothian Subdivision (MP 49.3 – MP 47):

- On September 8, 2010, flood water from Echo Lake washed out over 2,600 feet of track.
- On June 24, 2014, flood water from Echo Lake washed out over 528 feet of track.
- On September 22, 2018, flood water from Echo Lake washed out over 1,200 feet of track.
- On April 16, 2019, flood water from Echo Lake was reported by a train crew.
- On April 24, 2019, flood water from Echo Lake washed out over 2,600 feet of track, which contributed to the derailment and resulting fire of a denatured ethanol unit train UEBLTG20.

Echo Lake Park

Records indicate that the City of Fort Worth took ownership of Echo Lake on October 1, 2017, but through a conveyance agreement, Tarrant County was still responsible for all storm water and drainage repairs, including spillways. This ownership transfer also included a capital improvement and replacement project of Echo Lake's drainage system that Tarrant County was required to complete after an environmental review. At the time of the accident, an environmental review of the project was ongoing, and construction had not begun.

The drainage system at Echo Lake was designed with a primary spillway and emergency spillway. The primary spillway includes three drainage pipes. At the time of the accident, one of the three drainage pipes was functional, one had been intentionally plugged due to pipe damage,

[7] Fort Worth Meacham International Airport (KFTW) was the closest airport to the accident site. KFTW had Automated Surface Observing System whose weather reports were supplemented by air traffic control (ATC) when the ATC tower was in operation.

and the third had been blocked by debris. An emergency spillway for the lake was located along the UP right-of-way. (See figure 2.)

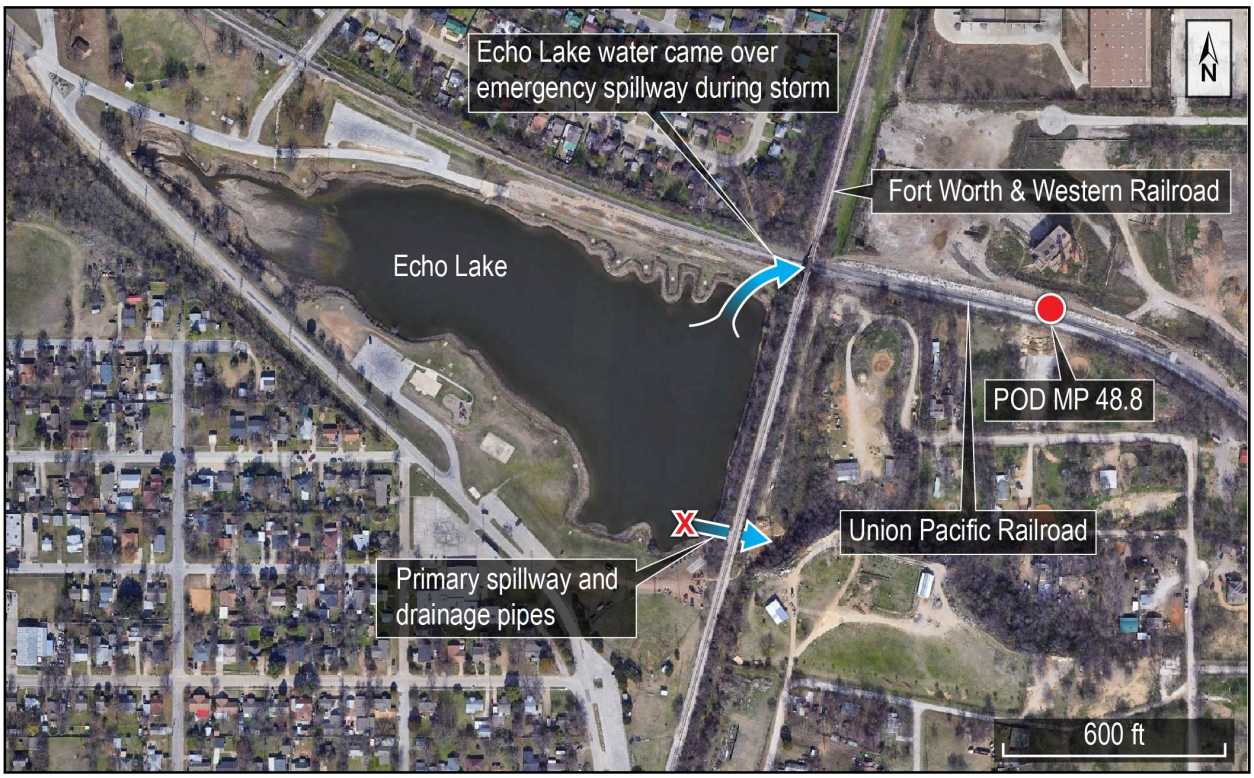

Figure 2. Aerial view of accident site depicting the primary spill way and drainage pipes and point of derailment at MP 48.8.

Track Examination

A heavy stream of water flowing south and in a downhill direction had washed away large amounts of subballast, shoulder and crib ballast along the track and several locations along the track had ballast that piled up and over both running rails.[8] At the derailment location, the water had flowed overtop and underneath of the track structure, undercutting and eroding away the tracks supporting ballast foundation, shoulder and crib ballast. The track structure had weakened to a point where it could not support the weight and dynamic loading of the train. NTSB investigators further observed that the track between the two curve transitions was damaged for several feet, due to the track losing support underneath the train as it traversed over that portion of the track. (See figure 3.)

[8] A *ballast* and *subballast* (track foundation) support rolling stock (vertical) weight, drainage, and track alignment. A *crib ballast* supports track alignment, drainage, including track compression and tension (longitudinal) forces.

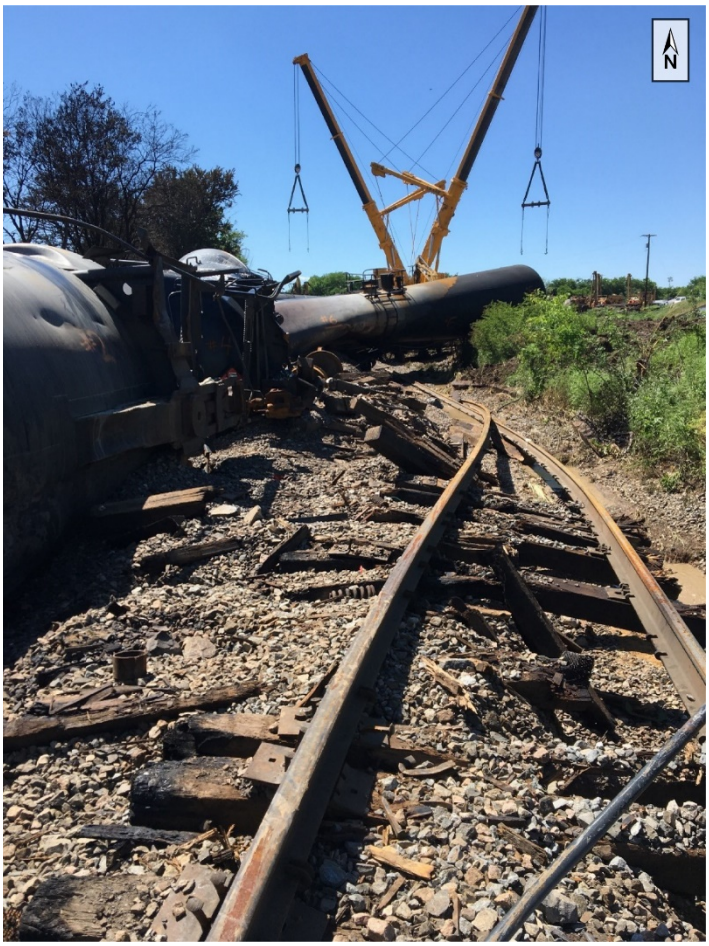

Figure 3. Photograph of the destroyed track infrastructure and three damaged tank cars.

Weather Notifications

Title 49 *Code of Federal Regulations* 213.239; *Special Inspections*, requires a railroad in the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, to conduct a special inspection of the track involved as soon as possible after the occurrence and, if possible, before the operation of any train over that track. This is a safeguard intended to validate the safety condition of the track structure and right-of-way for the safe movement of trains. Federal requirements do not mandate that these inspections be recorded or documented by the railroad.

UP train operations management personnel view weather graphics and discuss weather related issues each morning. This general management discussion is not conveyed to train crews. UP train crews and other railroad personnel report flooding and washout issues to the UP Harriman Dispatching Center, who, in return, notify the manager of track maintenance through a severe weather alert. The manager of track maintenance would then dispatch a track inspector to the affected area to initiate emergency track inspections and implement any corrective measures needed to protect the movement of trains. The UP Harriman Dispatching Center also receives weather data such as flash flood warnings and other weather notifications from a contracted service

with Accuweather. These warnings and notifications are then transmitted by the Dispatching Center to train crews by radio. Transmissions are logged and tracked within UP's dispatching software. According to UP officials, flash flood warnings are seen about 3,000 times per year and are normally based on specific events on a single day. Warnings do not include historical data based on known outcomes such a flooding or take into consideration cumulative events such as rainfall occurring over several days.

Train Crew Toxicology

The engineer and conductor submitted blood and urine samples for postaccident toxicological testing as required by Title 49 *Code of Federal Regulations* Part 219 and tested negative for alcohol. Although postaccident toxicology testing revealed levels of diphenhydramine in both the engineer's and conductor's urine, their operation of the train was consistent with a fully engaged crew.[9] No operating inconsistencies were noted by NTSB investigators.

Postaccident Action

The NTSB issued a Safety Recommendation Report based on the derailments of high hazard flammable trains in Fort Worth, Texas, and Draffin, Kentucky, which resulted in breached tank cars and hazardous material fires. The NTSB found that in both derailments, US Department of Transportation (DOT)-111 tank cars were placed in positions that increased the risk of derailment and breaching of the tank cars, resulting in release of their hazardous materials contents. The NTSB issued one recommendation to the Association of American Railroads, the American Short Line and Regional Railroad Association, and the Renewable Fuels Association; reiterated one recommendation to the Federal Railroad Administration; and reiterated two recommendations to the Pipeline and Hazardous Materials Safety Administration.[10]

UP made a change to operating rule 6.21 (Operating Rule 6.21, Precautions Against Unusual Conditions) for operating under a flash flood warning, emphasizing to train crews that they should "proceed prepared to stop prior to washout or debris on track." This differs from a previous version of the rule where speed would be governed through special instruction.

On September 30, 2020, NTSB investigators received an update from the City of Fort Worth Department of Parks and Recreation stating that a contractor for Tarrant County completed the drainage improvement work (per conveyance agreement) at the southeast corner of Echo Lake in June of 2020. Tarrant County and the City of Fort Worth continue to work on transferring the maintenance easements for the spillway drainage system. In addition to the completion of the drainage improvements, the Department of Parks and Recreation is aware that the railroad is pursuing a park conversion along the north boundary of Echo Lake Park, to construct a berm for further flood protection. At this time, there is no schedule for the completion of this work.

[9] *Diphenhydramine* is an antihistamine used to relieve symptoms of allergy, hay fever, and the common cold.

[10] See the National Transportation Safety Board's December 2, 2020, Safety Recommendation Report, *Placement of DOT-111 Tank Cars in High Hazard Flammable Trains and the Use of Buffer Cars for the Protection of Train Crews*, RSR-20/01 in the public docket (accident number RRD19FR007) by accessing the NTSB Accident Dockets link at www.ntsb.gov.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident is the derailment of Union Pacific Railroad train UEBLTG20 due to a weakened track structure and wash out resulting from a water overflow event due to rain causing Echo Lake to flood. Contributing factors include deferred maintenance of primary and emergency spillways at Echo Lake, and the absence of dynamic weather reporting criteria at Union Pacific Railroad.

Report Date: August 3, 2021

The NTSB has authority to investigate and establish the facts, circumstances, and cause or probable cause of a pipeline accident in which there is a fatality or substantial property damage, or significant injury to the environment. (49 U.S. Code, Section 1131 - *General authority*)

The NTSB does not assign fault or blame for an accident or incident: rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties…and are not conducted for the purpose of determining the rights or liabilities of any person." Title 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 U.S. Code, Section 1154(b).
