

**NATIONAL TRANSPORTATION SAFETY BOARD**  
**Public Meeting of October 30, 2018**  
**(Information subject to editing)**

**Derailment and Hazardous Materials Release of Union Pacific Railroad Unit Ethanol  
Train, Graettinger, Iowa**  
**March 10, 2017**  
**NTSB/RAR-18/02**

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

## **Executive Summary**

On March 10, 2017, about 12:50 a.m., central standard time, eastbound Union Pacific Railroad unit ethanol train, UEGKOT-09, with 3 locomotives, 98 loaded tank cars, and 2 buffer cars filled with sand derailed near milepost 56.8 at a timber railroad bridge near Graettinger, Iowa. Twenty loaded tank cars in positions 21 through 40 derailed. Fourteen of the derailed tank cars released about 322,000 gallons of undenatured ethanol, ethyl alcohol without a denaturant added to it, fueling a postaccident fire. The accident occurred near Jack Creek, a tributary of the Des Moines River. There were no injuries and three nearby homes were evacuated. About 400 feet of railroad track and a 152-foot railroad bridge were destroyed in the accident. Union Pacific Railroad estimated damages, excluding environmental remediation or the cost of clearing the accident, at \$4 million. At the time of the accident, the wind was from the northwest at 17 mph gusting to 30 mph, visibility was 10 miles, and the temperature was 10°F.

The following are safety issues in this accident:

- Adequacy of Union Pacific Railroad's track maintenance and inspection program
- Adequacy of the Federal Railroad Administration's oversight
- Transportation of fuel ethanol without the use of volatile organic chemical denaturants

## **Findings**

1. Union Pacific Railroad was not maintaining the track structure on the Union Pacific Railroad Estherville Subdivision in accordance with Federal Railroad Administration minimum track safety standards or its own internal track maintenance standards.

2. Union Pacific Railroad supervisors and managers were not ensuring defective crosstie conditions were being identified, reported, and remediated in accordance with Union Pacific Railroad track maintenance standards and Federal Railroad Administration track safety standards.
3. Federal Railroad Administration inspectors did not report all defective crosstie conditions on the Union Pacific Railroad Estherville Subdivision in the 2 years prior to the derailment.
4. Federal Railroad Administration inspectors were not using all available enforcement options, such as a recommendation for civil penalties, to require Union Pacific Railroad to comply with Federal Railroad Administration minimum track safety standards on the Union Pacific Railroad Estherville Subdivision.
5. Based on the observation of the fresh horizontal impact damage observed on the wheel tread of the 4th through the 20th nonderailed cars, examination of the rail recovered from the accident, the condition of the crosstie structure on the Union Pacific Railroad Estherville Subdivision, the train likely derailed from a broken south rail that occurred prior to or at the 20th car of the Union Pacific train UEGKOT-09 as it was traveling over the west approach of the Jack Creek Bridge, resulting from UP's inadequate track maintenance and inspection program and the FRA's inadequate oversight of the application of federal track safety standards.
6. A deteriorated track structure, such as worn rail and degraded track support conditions, will cause more track movement and higher stresses in the rail.
7. The finite element study demonstrates that worn 90-pound rail on a degraded track support will result in higher transverse stress in the rail head region, exposing the rail to increased risks of failure due to a vertical split-head failure mode.
8. Based on federal research and observed accident performance of tank car head protection systems in this accident, it is likely that had the legacy US Department of Transportation Specification-111 tank cars involved in this accident been replaced with US Department of Transportation Specification-117 tank cars equipped with head shields, breaches and punctures which resulted in the loss of hazardous material from six of the tank car heads could have been mitigated or prevented.
9. Tank car shell puncture resistance improvements required for new or retrofitted US Department of Transportation Specification-117 tank cars transporting flammable liquids that are scheduled to replace the existing fleet of US Department of Transportation Specification-111 ethanol tank cars by May 1, 2023, could have mitigated and might even have prevented some of the tank shell breaches from six of the tank cars involved in this accident.
10. If the tank cars involved in this accident had been retrofitted or replaced with US Department of Transportation Specification-117 compliant tank cars, the breaching damage to the top fittings of the 21st and 25th tank cars could have been avoided.

11. Ethanol would not have released from the 22nd tank car had it been equipped with a bottom outlet valve operating mechanism that was designed to prevent actuation during an accident scenario.
12. Since the Pipeline and Hazardous Materials Safety Administration has not established a clear set of intermediate metrics for evaluating tank car conversion and replacements, achievement of the deadlines may be overly reliant on future market and economic conditions.
13. Given the minimal thermal damage to tank cars, or lack of energetic postaccident fireball eruptions, and less environmental impact observed in this accident compared with similar railroad accidents involving denatured fuel ethanol, it would appear a safety benefit could be derived from transporting ethanol without the use of volatile denaturant chemicals.
14. More research should be conducted to determine whether operational changes to shipping ethanol in its undenatured form would improve safety.
15. The erroneous shipping documentation identifying the hazardous material as denatured alcohol, instead of undenatured ethanol, did not have any adverse impact on the emergency response to this accident.
16. None of the following were factors in this accident: (1) the mechanical condition of the train to include the train's braking system, (2) the performance of the train crew, (3) cell phone use by the train crew, (4) alcohol or other drugs by the train crew, and (5) the emergency response.

## **Probable Cause**

The National Transportation Safety Board determines that the probable cause of the derailment was a broken rail that occurred as the train was traveling over the west approach of the Jack Creek Bridge resulting from Union Pacific Railroad's inadequate track maintenance and inspection program and the Federal Railroad Administration's inadequate oversight of the application of federal track safety standards. Contributing to the consequences of this accident was the continued use of US Department of Transportation Specification-111 tank cars.

## **Recommendations**

### **New Recommendations**

As a result of these investigations, the National Transportation Safety Board makes the following new safety recommendations:

#### **To the Federal Railroad Administration:**

1. Provide additional training to all your track inspectors on regulatory track safety standards compliance and provide guidance of available enforcement options to obtain

compliance with minimum track safety standards when defective conditions are not being properly remediated by railroads on all routes that carry high hazardous flammable materials.

**To the Pipeline and Hazardous Materials Safety Administration:**

2. Sponsor research to study and publish the difference in characteristics between denatured and undenatured ethanol and the benefits that could be achieved by transporting fuel ethanol without the use of volatile organic chemical denaturants.

**To Union Pacific Railroad:**

3. Reexamine your track maintenance and inspection program standards on all routes that carry high hazardous flammable materials and ensure those track inspection standards are complied with by both track inspectors and track supervisors.

**Previously Issued Recommendation Reiterated in this Report**

As a result of this investigation, the National Transportation Safety Board reiterates the following previously issued safety recommendation:

**To the Pipeline and Hazardous Materials Safety Administration:**

1. Require an aggressive, intermediate progress milestone schedule, such as a 20 percent yearly completion metric over a 5-year implementation period, for the replacement or retrofitting of legacy DOT-111 and CPC-1232 tank cars to appropriate tank car performance standards, that includes equipping these tank cars with jackets, thermal protection, and appropriately sized pressure relief devices. (R-15-16)