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Norfolk Southern Railway Train Derailment with Subsequent Hazardous Materials Release and Fires

East Palestine, Ohio
February 3, 2023

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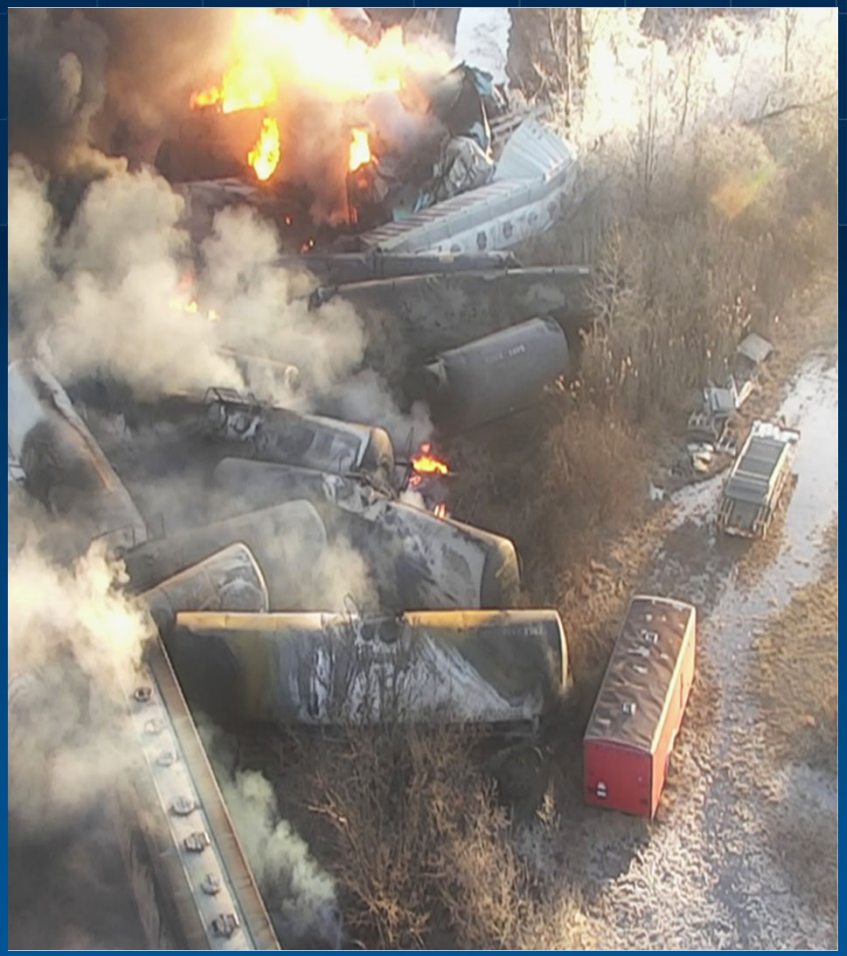
Accident Overview

R. Payan
Investigator-in-Charge



Eastbound NS Train 32N

Map source: ESRI and Google Maps

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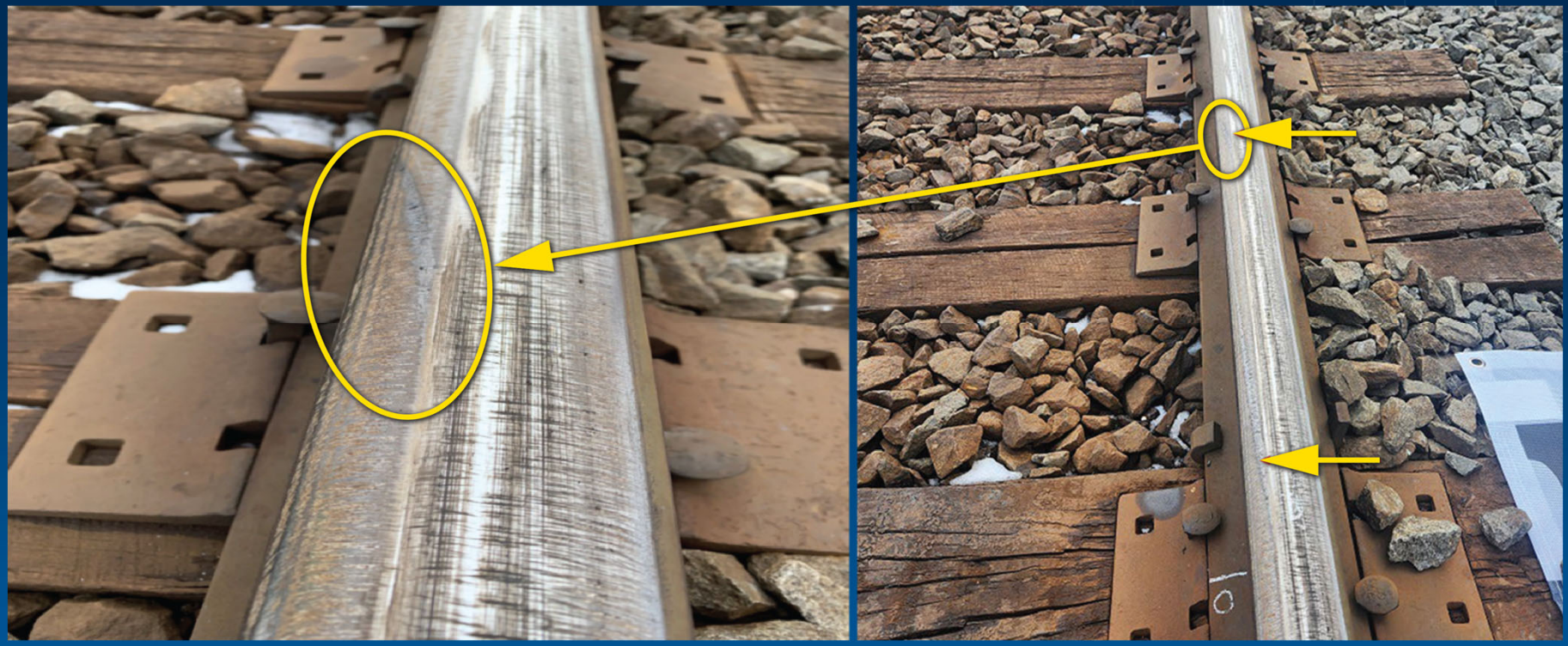
Point of Derailment



Wheel Set 1

Wheel Set 1 – Opposite View

L1 Journal

Defect Detector Locations

39	Dragging Equipment Detectors
10	Hot Wheel Detectors
1	TBOGI Detector
1	Wheel Impact Load Detector
39	Hot Bearing Detectors

Map source: ESRI and Google Maps

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Defect Detector Locations

Hot Bearing Detectors

	HBD Sebring	HBD Salem	HBD East Palestine
Distance from Point of Derailment	30 miles	20 miles	0.3 miles
Detector Data (GPLX 75465 Lead Axle Bearing)	L1 Axle Bearing = 38ºF R1 Axle Bearing = 18ºF	L1 Axle Bearing = 103ºF R1 Axle Bearing = 20ºF	L1 Axle Bearing = 253ºF R1 Axle Bearing = 20ºF
Train 32N crew	No radio broadcast	No radio broadcast	Critical Alarm radio broadcast
NS ATC Desk	No alert	Non-Critical Alert	No data

Emergency Response

- 8:54 pm Train Derailment
- 8:56 pm 911 call placed to East Palestine Police
- 8:58 pm 1st Alarm to Station 24
- 9:00 pm East Palestine Fire on scene
- 9:01 pm 2nd alarm to station 24
- 9:04 pm NS in Atlanta GA contacted
- 9:07 pm Haz Mat team, Engine and Tanker from Springfield requested
- 9:08 pm All available personnel from Station 11 and 24 requested

Emergency Response

- 9:10 pm Columbiana County EMA notified
- 9:15 pm Beaver County EMA notified
- 9:19 pm Train 32N requests to cut the locomotive away from train #
- 9:24 pm East Liverpool Hazmat received notification of activation
- 9:27 pm Train 32N moves 1-mile away from train
- 9:35 pm Beaver County Emergency Services notified of requested assistance
- 9:45 pm Initial evacuation of residential homes initiated
- 10:23 pm East Liverpool Hazmat received consist from Columbiana County EMA

Emergency Response

- 10:34 pm Ohio State Patrol advised a 1-mile evacuation
- 11:00 pm NS Haz Mat personnel arrived on-scene
- 00:00 am Fire suppression operations are suspended

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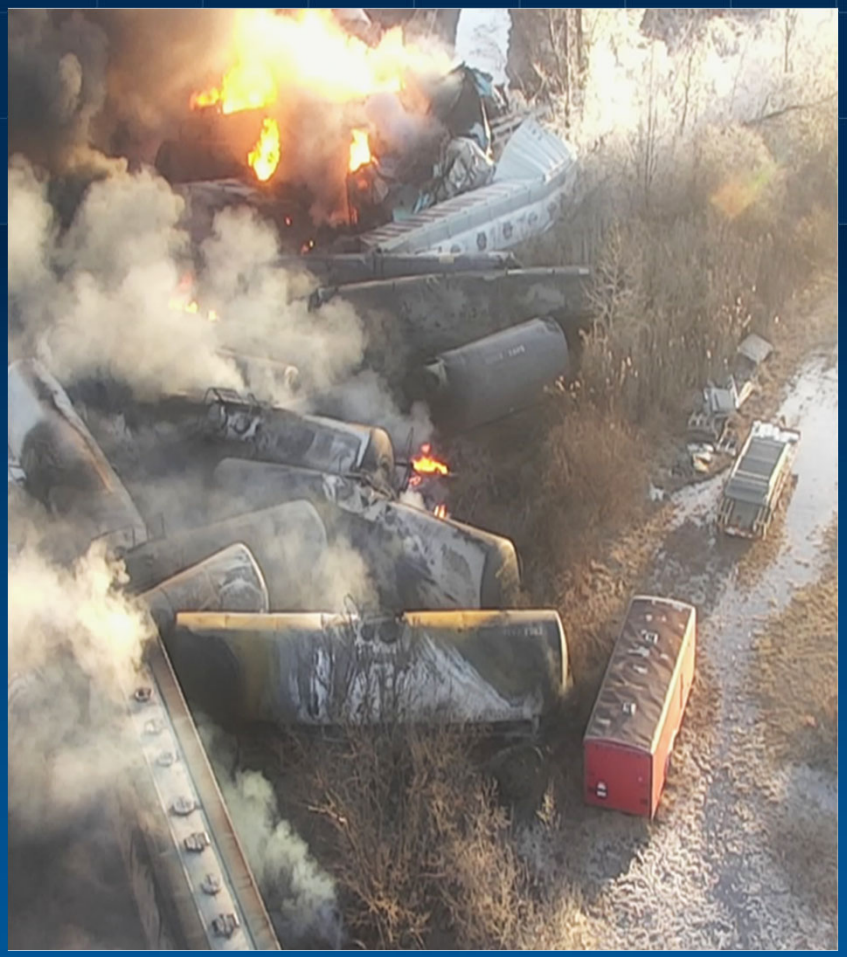
Hazardous Materials Release

P. Stancil
Senior Hazardous Materials Investigator



Norfolk Southern Railway Train 32N – Hazardous Materials

20 Placarded Tank Cars – 11 Derailed

- Vinyl Chloride Monomer, Stabilized: flammable gas, 5 tank cars, 115,580 gallons
- Spent Sulfuric Acid: corrosive liquid, 5 tank cars, 70,000 gallons
- Butyl Acrylates, Stabilized: flammable liquid, 2 tank cars, 60,000 gallons
- Ethylene Glycol Monobutyl Ether: combustible liquid, 2 tank cars, 51,000 gallons
- Ethyl Hexyl Acrylate: combustible liquid, 2 tank cars, 55,000 gallons
- Benzene: flammable liquid, 2 tank cars, residue/empty
- Isobutylene: flammable gas, 1 tank car, 33,000 gallons
- Liquefied Petroleum Gas: flammable gas, 1 tank car, residue/empty

Released Hazardous Materials

Line #	Car Number	Commodity	Amount Released	Breaching Damage
28	TILX402025	Vinyl Chloride Monomer	Entire Load	*Vent and Burn
29	OCPX80235	Vinyl Chloride Monomer	Entire Load	*Vent and Burn
30	OCPX80179	Vinyl Chloride Monomer	Entire Load	*Vent and Burn
31	GATX95098	Vinyl Chloride Monomer	Entire Load	*Vent and Burn
36	SHPX211226	Ethylene Glycol Monobutyl Ether	Entire Load	Head crack, open bottom outlet valve
38	DOWX73168	Ethylhexyl Acrylate	Partial Load	Head crack and puncture
50	UTLX205907	Butyl Acrylates	Entire Load	Head puncture
55	OCPX80370	Vinyl Chloride Monomer	Entire Load	*Vent and Burn

** Tank cars not breached in the initial derailment*

Vent and Burn Actions for 5 Vinyl Chloride Tank Cars

East Palestine, Ohio, February 6, 2023, 4:40 p.m.

Examinations and Testing – Derailment Damage

Hazardous Materials Tank Cars

- DOT-111 flammable and combustible liquids tank cars:
  - Head cracks and mechanical puncture – 3 tank cars
  - Operating handle opened the bottom outlet valve of 1 tank car
- DOT-105 vinyl chloride monomer tank cars:
  - No evidence of mechanical breaching damage immediately following derailment
  - Aluminum protective housing covers melted and destroyed – 3 tank cars
  - Melted aluminum entered pressure relief devices – 3 tank cars
  - Aluminum valve handwheels melted and destroyed - 4 tank cars
  - Tank shells punctured by vent and burn explosive charges – 5 tank cars

Examinations and Testing – Derailment Damage

Hazardous Materials Tank Cars

DOWX73168 cracked tank head

SHPX211226 open bottom outlet

OXPX80235 missing aluminum PH cover

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Examinations and Testing – Tank Residues

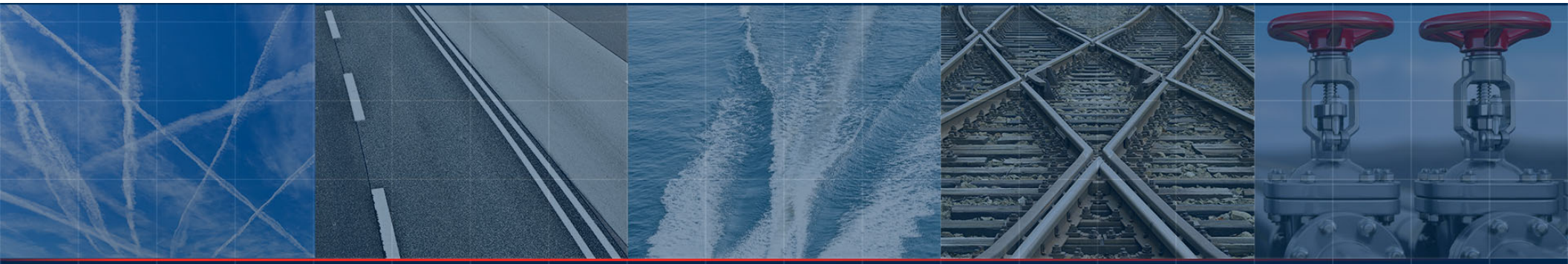
DOT-105 Vinyl Chloride Tank Cars

- Laboratory Testing of post-vent and burn tank residue samples analyzed at Oxy Vinyls Technical Center PVC Laboratory for evidence of polymerization
- Tests included scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), thermogravimetric analysis (TGA), and Fourier-Transform infrared spectroscopy
- Oxy Vinyls concluded that no polyvinyl chloride (PVC) was present in any sample

Examinations and Testing – Valves and Pressure Relief Devices

DOT-105 Vinyl Chloride Tank Cars

- No polymerized material obstructed pressure relief devices
- Several O-rings were heat damaged
- Valve and pressure relief device components for one tank car destroyed by fire
- Pressure relief device components were severely corroded



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