

# National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



RRD23MR005

## **METEOROLOGY**

Specialist's Factual Report - Supplemental

August 22, 2023

## A. ACCIDENT

Location: East Palestine, Ohio  
Date: February 3, 2023  
Time: 2054 eastern standard time (EST)  
0154 coordinated universal time (UTC) on February 4, 2023  
Train: Norfolk Southern freight train derailment with hazardous material

## B. METEOROLOGY INVESTIGATOR

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Senior Meteorologist  
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National Transportation Safety Board  
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## C. DETAILS OF THE INVESTIGATION

This supplemental report documents the conditions over the Houston area where one or more of the rail cars spent an excessive number of days in the railyard without moving and exposed to potential flooding and high water levels. This report documents events of heavy rainfall amounts in the Houston area during the period between 2016 through 2022, which included four tropical storms/hurricanes which impacted the area.

## D. FACTUAL INFORMATION

One of the major railyards noted in the data search was for La Porte, is located in Harris County, Texas, which is located immediately east of the city of Houston. The closest NWS weather reporting station with climatological data was from Houston Hobby Airport (HOU) which was located 14 miles west of the rail yard. The following table of HOU rainfall was reported between 2022-2016, with the precipitation departure from normal.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>2022</b>	3.22 (-0.87)	0.78 (-2.07)	2.46 (-0.82)	1.72 (-2.36)	3.08 (-2.34)	0.35 (-5.74)	1.90 (-2.69)	4.52 (-0.92)	1.52 (-4.24)	2.82 (-2.96)	7.21 (+3.31)	2.71 (-1.63)	32.29 (-22.51)
<b>2021</b>	1.71 (-2.16)	1.90 (-1.31)	1.51 (-1.69)	2.28 (-1.80)	10.38 (+4.96)	6.12 (+0.03)	7.23 (2.64)	3.86 (-1.58)	7.61 (+1.85)	2.75 (-3.03)	2.23 (-1.67)	1.85 (-2.49)	49.43 (-5.47)
<b>2020</b>	4.92 (+1.05)	2.20 (-1.01)	0.48 (-2.72)	2.82 (-0.43)	8.06 (+3.31)	4.57 (-2.53)	7.36 (+2.70)	3.20 (-1.86)	13.07 (+7.86)	1.13 (-4.86)	4.40 (+0.08)	8.04 (+4.01)	60.25 (+5.60)

<b>2019</b>	4.16 (+0.29)	3.29 (+0.08)	0.54 (-2.06)	2.21 (-1.04)	11.05 (+6.30)	7.38 (+0.28)	0.38 (-4.28)	7.11 (-4.28)	11.48 (+6.27)	4.21 (-1.78)	2.14 (-2.18)	0.84 (-3.19)	54.79 (+0.14)
<b>2018</b>	3.30 (-0.57)	3.94 (+0.73)	1.93 (-1.27)	2.71 (-0.54)	3.60 (-1.15)	4.17 (-2.93)	7.99 (+3.33)	1.69 (-3.37)	8.25 (+3.04)	6.88 (+0.89)	1.84 (-2.48)	6.20 (+2.17)	52.50 (-2.15)
<b>2017</b>	4.07 (-0.02)	2.05 (-0.80)	8.15 (+4.87)	2.98 (-1.10)	2.68 (-2.74)	5.20 (-0.89)	3.12 (-1.47)	38.87 (+33.43)	3.75 (-2.01)	2.52 (-3.26)	1.11 (-2.89)	4.66 (+32)	79.16 (+24.51)
<b>2016</b>	2.51 (-1.58)	1.66 (-1.19)	4.14 (+0.86)	8.95 (+4.83)	7.59 (+2.17)	8.83 (+2.74)	5.41 (+0.82)	8.22 (+2.78)	2.31 (-3.45)	0.98 (-4.80)	2.53 (-1.37)	3.69 (-0.65)	56.82 (+1.89)

A review of heavy rain events over the Houston/La Porte, TX area during the period were as follows.

### Review 2022 data

No tropical storms impacted the Texas coast in 2022.

Oct. Between October 27-28, 2022, HOU reported 2.44 inches of rainfall.

Nov. Between November 24-26, 2022, HOU reported 3.10 inches.

### Review of 2021 data

May HOU reported from May 16-25, 2021, a total of 7.76 inches of rainfall.

June HOU recorded 2.17 inches of precipitation on June 28, 2021.

July HOU recorded 1.55 inches on July 6, 2021.

Aug. HOU recorded 1.88 inches on Aug. 15, 2021.

Sept. HOU reported between Sept. 12-15, a total of 3.97 inches associated with Hurricane Nicholas.

**Hurricane Nicholas September 12-15, 2021.** Nicholas was a Category 1 hurricane (on the Saffir Simpson Hurricane Wind Scale) that made landfall on the eastern portion of the Matagorda Peninsula. Combined with the tides, Nicholas's surge resulted in coastal inundation levels of 3 to 6 ft along portions of the middle and upper Texas coast. The storm slowly weakened and moved slowly over eastern Texas and Louisiana producing heavy rainfall of 4 to 9 inches, which resulted in significant flooding across the region (figure 1). The most significant counties included parts of Brazoria, Galveston, and Harris Counties, which included La Porte. Between September 12-15, HOU reported 3.97 inches of rainfall.

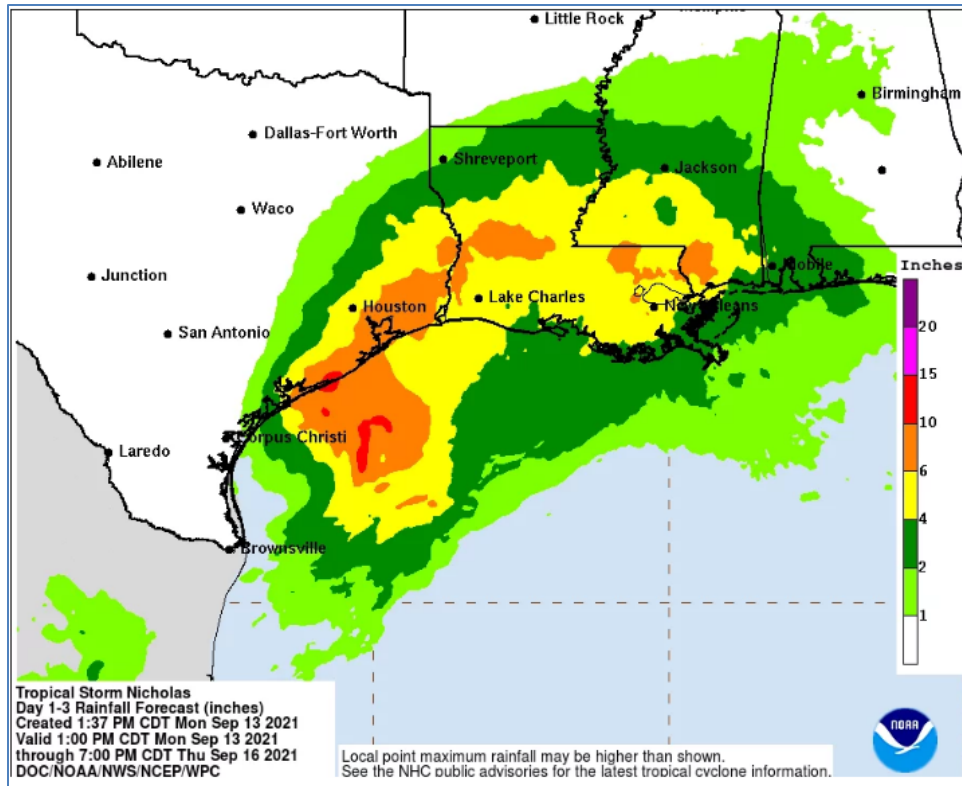


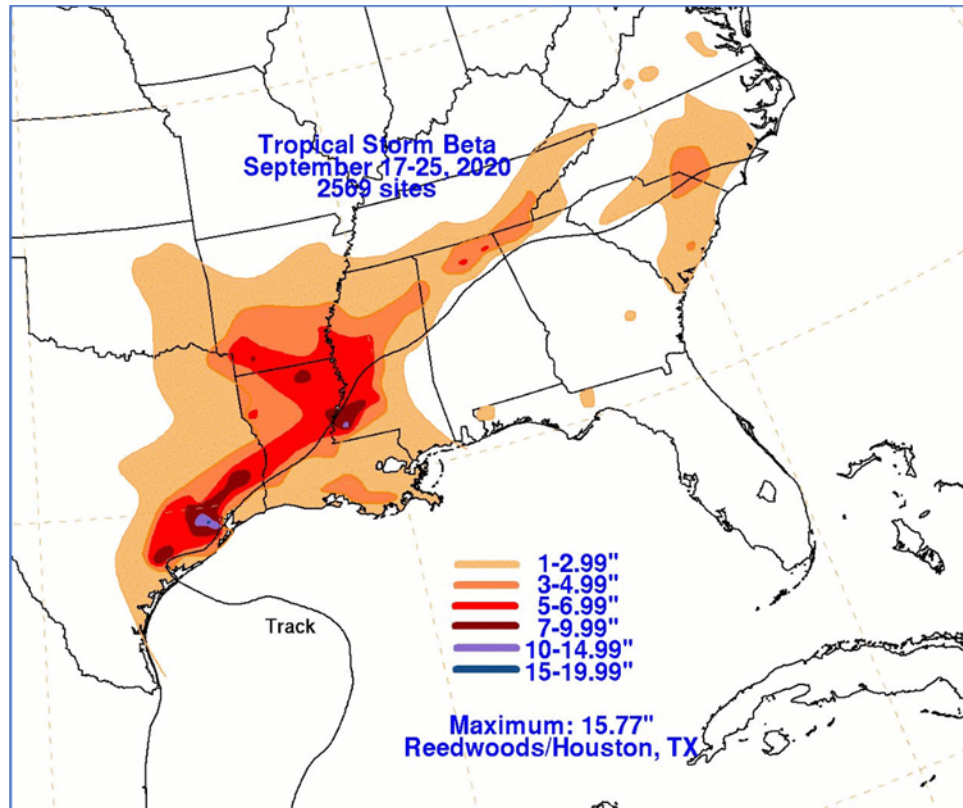
Figure 1 - Hurricane Nicholas heavy rainfall on September 13, 2021.

### Review of 2020 data

May HOU recorded 2.17 inches of rainfall on May 5, 2020, which the highest amount recorded for the month, which was associated with thunderstorms during the late afternoon into the evening.

Sept. HOU reported between September 20-23, 2020, a total of 12.36 inches associated with slow moving Tropical Storm Beta.

**Tropical Storm Beta** produced a storm surge of 2 to 4 ft along the coasts of Texas, Louisiana, and Mississippi. The storms slow motion as it weakened caused widespread heavy rainfall across southeastern Texas, with the heaviest rains falling on Harris County. With numerous reports of 10 to 14 inches across the region (figure 2), which resulted in major flooding.



**Figure 2 - Tropical Storm Beta heavy rainfall September 17-25, 2020.**

### Review of 2019 Data

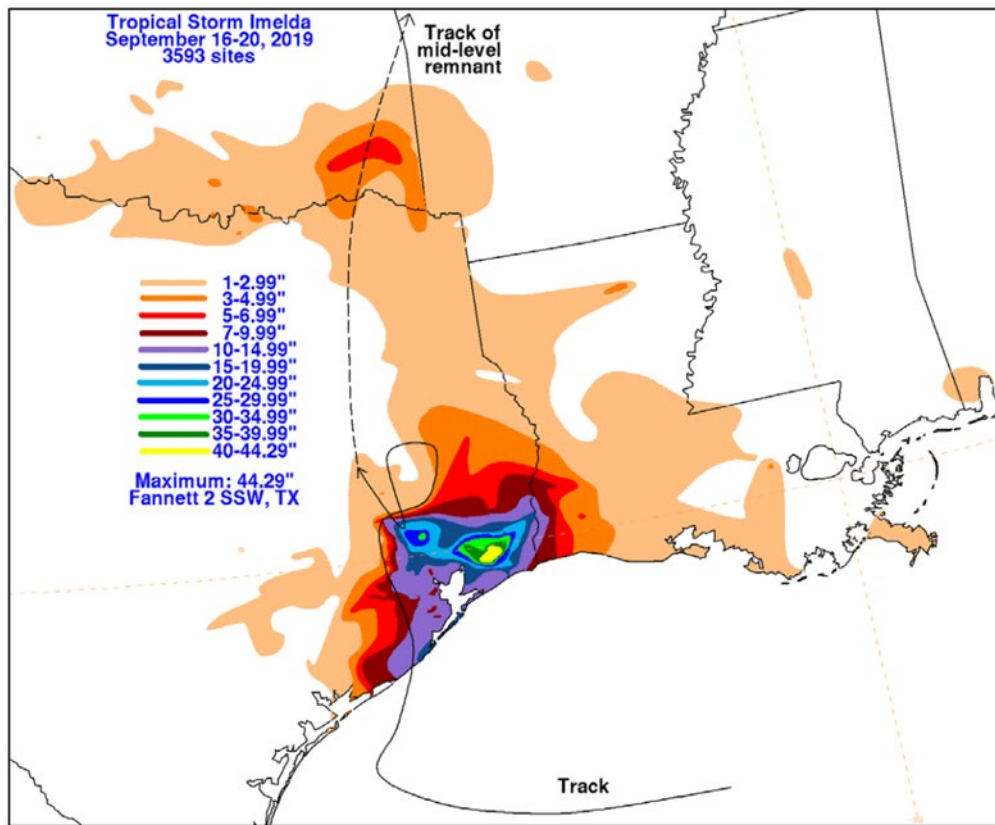
May HOU between May 7-12 reported 8.74 inches associated with thunderstorms.

June HOU reported on June 5, 2019, 2.68 inches of rain.

Sept. HOU reported from September 16-20, 2019, a total of 11.08 inches of rain from Tropical Storm Imelda, which caused significant flooding over the area.

**Tropical Storm Imelda**, September 17-19, 2019. The origins of Imelda formed from a mid- to upper-level trough as it moved southward over the Gulf of Mexico, where it intensified into an area of intense convection, and became a tropical depression on September 17, 2019. Intense convective bursts caused the depression to intensify over the next few hours, and the depression became a tropical storm with 35 kt winds by 1000 CDT immediately south of the Texas coast, and moved northward and made landfall near Freeport, TX, about 1245 CDT. The storm rapidly weakened once inland and producing heavy rainfall over southeast Texas and southwestern Louisiana. By 1900 CDT on September 18th the depression further weakened into a broad trough of low-pressure while still producing significant precipitation as it moved northward into Oklahoma.

A steady influx of deep tropical moisture into Imelda and its remnants, combined with the system's slow motion over eastern Texas, produced widespread rainfall amounts greater than 30 inches across several counties, including portions of the Houston and Beaumont, TX. Figure 3 is a map of the rainfall from Tropical Storm Imelda between September 15-20, 2019, with the La Porte area in an area of generally 10 to 14.99 inches of rainfall during the period. The highest rainfall total was 44.29 inches recorded in Fannett, TX, located east of the La Porte station. The rainfall caused devastating flooding along the I-10 corridor east of Winnie through Fannett, Beaumont, Vidor, and Orange, TX.



**Figure 3 - Tropical Storm Imelda rainfall September 16-19, 2019.**

### Review of 2018 data

Sept. Between September 20-23, 2018, HOU recorded 12.36 inches of rainfall associated with thunderstorms ahead of an approaching frontal system.

Oct. On October 31, 2018, HOU reports 2.60 inches of rainfall associated with thunderstorms.

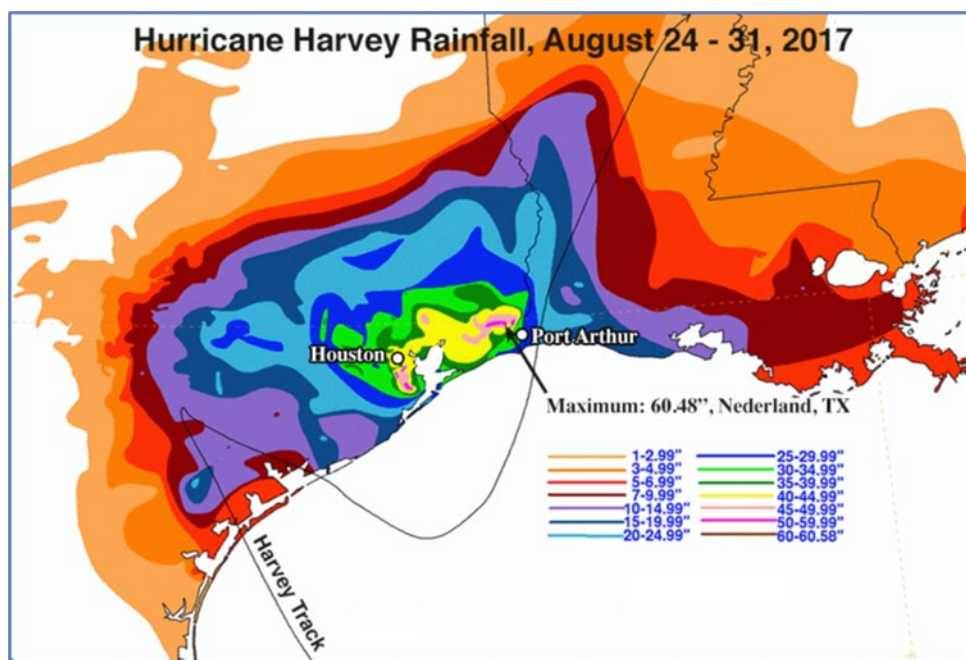
Dec. Between 7-8 December 2018 a low pressure system and frontal system produced 3.78 inches of rain at HOU. The highest rainfall total for the month.

### Review of 2017 data

Mar. From 4-7 March 2017, HOU records 4.5 inches of rainfall, with 4.79 falling on March 5th.

Aug. From 25-29 August 2017, HOU recorded 37.01 inches rainfall associated with Hurricane Harvey, with higher precipitation amounts near 48 inches in the La Porte area.

**Hurricane Harvey, August 17 through September 1, 2017.** A major category 4 hurricane made landfall along the middle Texas coast on August 28, 2017. The storm then stalled, with the center of the storm over or near the coast for four days and resulting in over 60 inches of rainfall (figure 4) over southeastern Texas. The rains caused catastrophic flooding over the region, with approximately 48 inches of rainfall reported in the La Porta area. Largely due to the flooding Hurricane Harvey is the second-most costly hurricane in U.S. history, behind only Hurricane Katrina in 2005.



**Figure 4 - Hurricane Harvey heavy rainfall between August 24-31, 2017.**

### Review of 2016 Data

April April 18, 2016, HOU 5.16 inches.

May May 27, 2016, HOU recorded 2.64 inches.

June June 1-5, 2016, HOU recorded 5.0 inches  
June 12, 2016, HOU 1.71 inches.

July July 25-26, 2016, HOU recorded 5.13 inches.

Aug. August 13, 2016, HOUS recorded 2.73 inches with a total from Aug. 13-26, of 7.3 inches.

Submitted By:

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