National Transportation Safety Board
Office of Highway Safety
Washington, DC 20594

HWY24MH013

HAZARDOUS MATERIALS

Group Chair's Factual Report

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A. CRASH

Location: Swanton, Lucas County, Ohio
Date: August 15, 2024
Time: 5:29 a.m. EDT

B. HAZARDOUS MATERIALS GROUP

Group Chair	Crystal G. Thomas National Transportation Safety Board Washington, DC
Group Member	Melanie Kurtz Ohio Public Utilities Commission Columbus, OH
Group Member	Thomas Huff Ohio Public Utilities Commission Columbus, OH

C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Information and Summary Report*, which can be found in the NTSB docket for this investigation.

As a result of the crash, the cargo contained inside the tractor trailer released from the front of the trailer onto the roadway as shown in Figure 1.

Figure 1. Photograph taken on August 15, 2024, showing the damaged tractor trailer and cargo released onto the roadway post-crash. (Source: Ohio EPA)

D. DETAILS OF THE INVESTIGATION

1.0 Carrier Information

The carrier involved in this crash was CJJ Industries, Inc, located in Summit, Illinois.

2.0 Events Preceding the Crash

On the night of Wednesday, August 14, 2024, the Shift Supervisor[1] moved the trailer[2] from the yard to the loading dock at the Brenntag Great Lakes LLC (Brenntag), Chicago, Illinois, terminal and opened loading dock door #3 at around 10:46 p.m. CDT.[3] He then reviewed the shipping paperwork to determine how to load the cargo

[1] The Shift Supervisor is responsible for loading and unloading transfers that go from the Chicago terminal to the Brenntag facilities in St. Paul, Minnesota and Milwaukee, Wisconsin, and oversees outbound trucks that go to local Brenntag facilities, which are done by the Shift Lead.
[2] The trailer was approximately 53 feet in length and 8 feet in width.
[3] All times listed in this report are CDT.

onto the trailer.[4] The trailer contained 12 empty wooden pallets,[5] arranged in four stacks of three pallets, positioned in the front of the trailer as dunnage.[6,7] The Shift Supervisor left the empty pallets in the trailer and began to load the cargo into the trailer using a forklift at around 11:25 p.m. Cargo was loaded into the trailer in the following sequence:[8]

- (5) Stainless steel IBC – UN1230, Methanol Solution
- (3) Supersack shrink-wrapped on pallet – Salt System Saver Pellets
- (1) Shrink-wrapped pallet of four drums – APG 325 N
- (1) Shrink-wrapped pallet of brown sacks – Citric Acid Anhydrous
- (1) Strapped pallet of four steel drums – UN1993, Flammable Liquids, N.O.S. (Acetone, Toluene)
- (1) Shrink-wrapped pallet of four plastic drums – S-MAZ
- (2) Strapped pallet of four plastic drums – UN2586, Aryl Sulfonic Acids, Liquid
- (2) Composite IBC – UN2735, Amines, Liquid, Corrosive, N.O.S
- (1) Plastic drum – UN2586, Aryl Sulfonic Acids, Liquid
- (1) Steel Drum – Coconut oil

The last two single drums were loaded on the trailer at around 11:42 p.m. The Shift Supervisor entered the trailer at around 12:01 a.m. on Thursday, August 15, 2024, at which time he placed paperwork in the pouch located near the rear of the trailer and installed a ratchet strap behind the last row of cargo. He exited the trailer less than a minute later; at which time he closed the loading dock door.

According to the Shift Supervisor, the cargo was loaded into the trailer in a side by-side configuration, from left to right, on the floor of the trailer as shown in Figure 2. He indicated that everything goes into the trailer "fitting as tightly as possible to ensure that nothing shifts, falls over, or has any complications."[9] He told investigators that he put cardboard sheets in between the bags and drums, but no other cushions or buffers were used on this load. Once everything was loaded into the trailer he attached a fabric strap to the rail on the side of the trailer behind the

[4] The Shift Supervisor indicated that he organizes the loads in a manner of weight to ensure that weight is spread out evenly throughout the trailer.
[5] The dimensions of each empty pallet were approximately 4 ft x 4 ft x 1 ft.
[6] Dunnage is used to occupy space in the trailer where you do not have materials loaded and to balance weight in the trailer.
[7] Refer to Brenntag Shift Supervisor interview in the docket for this investigation.
[8] Refer to the Screenshots from Brenntag Loading Dock Video in the docket for this investigation.
[9] Hall Interview transcript (p. 20, lines 8-11).

load, attached the other end of the strap to the rail on the opposite side of the trailer, pulled in tight, and cranked the latch to secure the load from movement. The Shift Supervisor indicated that there are typically two straps in the trailer, however this trailer only had one. According to the Shift Supervisor, the trailer was approximately 80-percent full, which he considered to be about average for how trailers were typically loaded. He also indicated that he would normally fill the rear of the trailer with empty totes, but did not have any available at the time, so there was open space in the rear of the trailer.

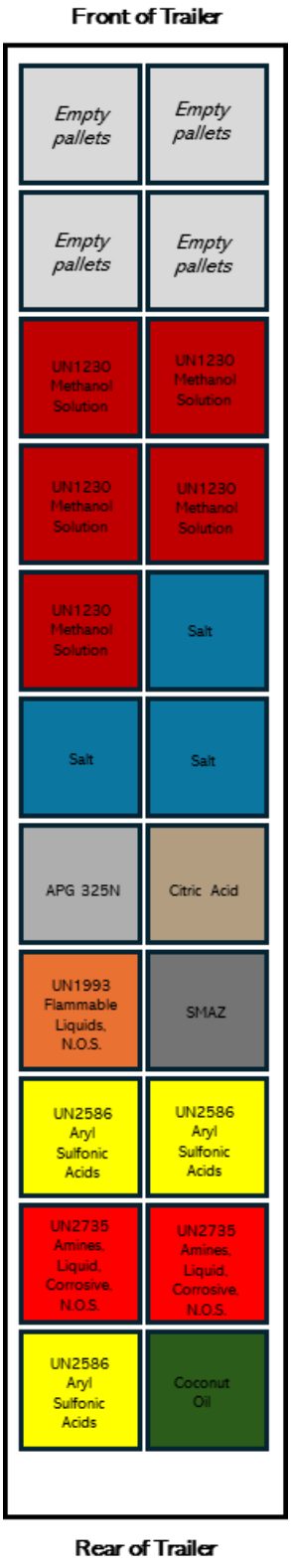

Figure 2. Configuration of load inside of trailer. [Note: not to scale]

The driver of the tractor trailer arrived at the CJJ Industries, Inc (CJJ), Summit, Illinois, facility at around 11:30 p.m. on August 14, 2024, to begin his shift.[10] He left the CJJ facility at around 11:48 p.m. and arrived at the Brenntag terminal on Thursday, August 15, 2024, at about 12:03 a.m. When the driver arrived at the terminal, Brenntag had completed loading the trailer and left the shipping invoice in the back of the trailer for the driver.[11] The driver hooked up his truck-tractor to the trailer and pulled it off the dock. After pulling away from the dock, the driver looked inside the trailer to make sure the cargo was strapped up, verified the load against the shipping invoice, closed the trailer doors, and affixed the proper placards to the trailer. After completing these tasks, the driver departed the Brenntag terminal at around 12:37 a.m. and began his trip to the Brenntag, Toledo, Ohio, terminal. At approximately 5:34 a.m. the driver was traveling eastbound on the Ohio Turnpike near MP 49 when he struck the rear of a passenger vehicle causing the truck-tractor to separate from the trailer and the hazardous materials cargo to release onto the roadway via the front of the trailer.

3.0 Shipper Information

The shipper involved in this crash was Brenntag Great Lakes LLC, located in Chicago, Illinois.

4.0 Hazardous Materials Information

According to the bill of lading for the shipment, the tractor trailer involved in the crash was carrying four types of hazardous materials, as shown in Table 1.[12] The hazardous materials contained in the trailer included: Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], Flammable Liquids, N.O.S.[13] (Acetone, Toluene) [BGL Lacquer Thinner LT-R], Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), and Aryl Sulfonic Acids, Liquid [Calsoft® LAS-99].

Table 1. List of hazardous materials contained in shipment

[10] Refer to Mack Driver Time Sheet in the docket for this investigation.
[11] Refer to Mack Driver Interview in the docket for this investigation.
[12] Refer to Bill of Lading in the docket for this investigation.
[13] "N.O.S." is a U.S. Department of Transportation (DOT) abbreviation for Not Otherwise Specified. It is applied to groups of substances that are not referenced by a single technical name in DOT Hazardous Materials Regulations (HMR).

Quantity Shipped	Packaging	Gross Weight (lbs)	Product
5	2,257 lb Stainless Steel IBC	13,785	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II
4	55-gal Steel Drum	1,673	UN1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II
2	2,150 lb Composite IBC	4,560	UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), Class 8, PG II
9	460-lb Plastic Drum	4,347	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII

4.1 UN1230, Methanol Solution

The Brenntag safety data sheet (SDS) for UN1230, Methanol Solution, Class 3, Packing Group II [Windshield Washer Fluid (Conc) Blend Concentrate],[14] states that the methanol solution is a highly flammable liquid. The SDS lists the flash point of the flammable liquid as 54.0°F (12.2°C)[15] and its specific gravity as 0.8.[16] The product is described as stable and non-reactive under normal conditions of use, storage and transport. According to the SDS, methanol solution causes serious eye irritation, is toxic if inhaled, may cause drowsiness, dizziness, headache, nausea, or vomiting, may damage fertility or an unborn child, and may cause damage to organs.

In case of an accidental release, the SDS advises keeping unnecessary personnel away and upwind of the spill/leak and eliminating all ignition sources in the area. In the case of small spills, the SDS advises using earth, sand or other non-combustible material to absorb the material, wiping it up with absorbent material, and cleaning the surface thoroughly to remove residual contamination.

Firefighting guidance includes using water fog, alcohol resistant foam, or carbon dioxide as suitable fire extinguishing media,[17] and specifies that water jet should not be used as an extinguishing media, as it will spread the fire. Vapors from this product may form explosive mixtures with air and may travel considerable distance to an ignition source and flash back.

4.2 UN1993, Flammable Liquids, N.O.S. (Acetone, Toluene)

The Brenntag SDS for UN1993, Flammable Liquids, N.O.S. (Acetone, Toluene), Class 3, Packing Group II [BGL Lacquer Thinner LT-R],[18] states that it is a highly flammable liquid, clear to hazy in color, with a hydrocarbon odor. The SDS lists the flash point of the flammable liquid as 1.0°F (-17.2°C) and estimates the lower

[14] Refer to the Safety Data Sheet (SDS) - Methanol Solution in the docket for this investigation.
[15] The SDS does not list the lower explosive limit (LEL) of upper explosive limit (UEL) for the product.
[16] Specific gravity is a measurement of the density of a substance in relation to the density of water (1.0) at the same temperature.
[17] Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
[18] Refer to the Safety Data Sheet (SDS) - Flammable Liquids, N.O.S. (Acetone, Toluene) in the docket for this investigation.

explosive limit (LEL) of the product as 2% and the upper explosive limit (UEL) as 10.15%. It has a specific gravity of 0.82. The product is described as stable and non-reactive under normal conditions of use, storage and transport. According to the SDS, the flammable liquid may be fatal if swallowed and introduced into the airways, is toxic if inhaled, causes skin irritation, serious eye irritation and damage to organs through prolonged or repeated exposure, may cause respiratory irritation, drowsiness or dizziness, and may damage fertility or the unborn child.

In case of an accidental release, the SDS advises keeping unnecessary personnel away and upwind of the spill/leak and eliminating all ignition sources in the area. In the case of small spills, the SDS advises using earth, sand or other non-combustible material to absorb the material, wiping it up with absorbent material, and cleaning the surface thoroughly to remove residual contamination.

Firefighting guidance includes using water fog, alcohol resistant foam, or carbon dioxide as suitable fire extinguishing media,[19] and specifies that water jet should not be used as an extinguishing media, as it will spread the fire. Vapors from this product may form explosive mixtures with air and may travel considerable distance to an ignition source and flash back.

4.3 UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine)

The Brenntag SDS for UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), Class 8, Packing Group II,[20] states it is a colorless, combustible liquid with an ammoniacal odor. It has a pH of 11.4, flash point of 176°F (80°C), vapor density of 2.6, and specific gravity of 0.96. The product is described as stable and non-reactive under normal conditions of use, storage and transport. According to the SDS, it is harmful in contact with skin, and causes severe skin burns and eye damage.

In the case of an accidental release, the SDS advises keeping unnecessary personnel away and upwind of the spill/leak and eliminating all ignition sources in the area. In the case of small spills, the SDS advises using earth, sand or other non-combustible material to absorb the material, wiping it up with absorbent material, and cleaning the surface thoroughly to remove residual contamination.

[19] Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
[20] Refer to the Safety Data Sheet (SDS) - Amines, Liquid, Corrosive, N.O.S. in the docket for this investigation.

Firefighting guidance includes using water fog, foam, dry chemical powder, or carbon dioxide as suitable fire extinguishing media, and specifies that water jet should not be used as it will spread the fire.

4.4 UN2586 Aryl Sulfonic Acids, Liquid

The Brenntag SDS for UN2586 Aryl Sulfonic Acids, Liquid [Calsoft® LAS-99], Class 8, Packing Group III,[21] states that it is a corrosive, brownish liquid with a sulfur dioxide odor. It has specific gravity of 1.06. The product is described as stable and non-reactive under normal conditions of use, storage and transport. According to the SDS, it causes severe skin burns and eye damage.

In the case of an accidental release, the SDS advises keeping unnecessary personnel away and upwind of the spill/leak. In the case of small spills, the SDS advises wiping up the product with absorbent material and cleaning the surface thoroughly to remove residual contamination.

Firefighting guidance includes using water fog, foam, dry chemical powder, or carbon dioxide as suitable fire extinguishing media, and specifies that water jet should not be used as it will spread the fire.

5.0 Packaging Information

The shipment on the trailer contained four types of hazardous materials packaging, including: steel intermediate bulk containers (IBC), steel drums, composite IBCs, and plastic drums.

5.1 Stainless Steel Intermediate Bulk Containers

The UN1230, Methanol Solution, 3, PG II was contained in five steel intermediate bulk containers (IBC) suitable for Packing Group II or III liquid hazardous materials, as shown in Table 2.[22,23] The five stainless steel IBCs involved in this crash are identified as Container #10, Container #11, Container #12, Container #13 and Container #14 (Figure 3). Each of the containers is a 350-gallon stainless steel stackable liquid IBC tote. Container #10 was manufactured by Precision IBC, Inc. in August 2006, and last tested in March 2024. Container #11 was manufactured by Precision IBC, Inc. in May 2007 and was last tested in May 2023. Container #12 was

[21] Refer to the Safety Data Sheet (SDS) - Aryl Sulfonic Acids, Liquid in the docket for this investigation.
[22] 31HA1/Y/6-24/USA/AA3964/3800Kg 1700Kg/1041L/55kg/70KpA/6-24/6-24
[23] 49 *CFR* Part 178.703, Marking of IBCs details the require markings manufacturers are to use.

manufactured by Clawson Container Company, Clarkston, Michigan, in August 2001, and was last tested in January 2024. Container #13 was manufactured by Clawson Container Company, Clarkston, Michigan, in October 2002, and was last tested in May 2023. Container #14 was manufactured by Clawson Container Company, Clarkston, Michigan, in October 1996, and was last tested in January 2024. Each of the five steel IBCs had a Class 3 Flammable Liquid label and UN1230 identification number affixed.

Table 2. List of stainless steel IBCs involved in crash

Container #	Product	Container Type	UN Marking	Manufacturer	Last tested	Post-Accident Condition
10	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II	Stainless Steel IBC	31A/Y/8-06/USA/M5406/7674/2722/1325/211/8-06/8-06/304S.S./2.34/0	Precision IBC, Inc	Aug-23	intact
11	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II	Stainless Steel IBC	31A/Y/05-07/CN/CIMC-DL/7622/2722/1325/190/05-2007/05-	Precision IBC, Inc	May-23	intact
12	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II	Stainless Steel IBC	31A/Y/8-01/USA/M4858/0/5000/1325L/350gal/304S.S./211	Clawson Container Company, Clarkston, MI	Jan-24	breached
13	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II	Stainless Steel IBC	31A/Y/10-02/USA/M4858/0/2861/1325L/350gal/304S.S./212	Clawson Container Company, Clarkston, MI	May-23	breached
14	UN1230 Methanol Solution [Windshield Washer Fluid (Conc) Blend Concentrate], 3, PG II	Stainless Steel IBC	31A/Y/10-96/USA/H4858/0/2097/1306L/345gal/304S.S./217	Clawson Container Company, Clarkston, MI	Jan-24	intact

Figure 3. Photo of stainless steel IBCs involved in crash.

Two of the five stainless steel IBCs were found to be breached post-crash. Container #12 was breached on one corner at the weld for a lifting lug/leg positioner (Figure 4 and Figure 5). The container was significantly damaged at this location with the corner dented inward. Container #13 was also breached on one corner at the weld for one of its lifting lugs/leg positioners (Figure 6 and Figure 7). Like Container

#12, this container was significantly damaged at this location with the corner severely dented inward. Both containers exhibited additional signs of physical damage including denting, scuffs and scratches. Some amount of product was released from both containers, however the actual volume of product released could not be determined. The remaining three stainless steel IBCs incurred some physical damage, including scuffs and scratches, but were not damaged on the corners and were not breached.

Figure 4. Photo of stainless steel IBC (Container #12) damage.

Figure 5. Close-up photo of stainless steel IBC (Container #12) damage showing breach location.

Figure 6. Photo showing stainless steel IBC (Container #13) damage.

Figure 7. Close-up photo of stainless steel IBC (Container #13) damage showing breach location.

5.2 Steel Drums

The UN1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II was contained in four non-removable head steel drums, suitable for Packing Group II or III liquid hazardous materials with a specific gravity lower than 1.4, as shown in Table 3. The steel drums were tested to a hydrostatic pressure of 150 kPa. Each of the four

steel drums (Container #16, Container #17, Container #19 and Container #23) were recently reconditioned and leakproof tested by Twin City Container, Inc., Hastings, Minnesota in 2024 (Figure 8).[24] Each of the four steel drum had a Class 3 Flammable Liquid label and UN1993 identification number affixed.

Table 3. List of Steel Drums involved in crash

Container #	Product	Container Type	Original UN Marking	Reconditioned UN Marking	Manufacturer	Post-Accident Condition
16	UN 1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II	Non-removable head steel drum	Xl.2/150/22 (*partiallyillegible)	1Al/Yl.4/150/USA/M5152/24RL	Twin City Container, Inc., Hastings, MN	breached
17	UN 1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II	Non-removable head steel drum	UN1Al/Xl.2/250 1.0-0.8-1.0	1Al/Yl.4/150/USA/M5152/24RL	Twin City Container, Inc., Hastings, MN	intact
23	UN 1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II	Non-removable head steel drum	UN1Al/Xl.4/250/22 1.0-0.8-1.0	1Al/Yl.4/150/USA/M5152/24RL	Twin City Container, Inc., Hastings, MN	intact
19	UN 1993, Flammable Liquids, N.O.S. (Acetone, Toluene), 3, PG II	Non-removable head steel drum	1.0-0.9-1.0 (*partiallyillegible)	1Al/Yl.4/150/USA/M5152/24RL	Twin City Container, Inc., Hastings, MN	intact

Figure 8. Photo of steel drums involved in crash.

One of the four steel drums (Container #16) was found to be leaking post-crash. Container #16 sustained significant physical damage including major dents, scratches and scuffs over the entirety of the body and heads of the drum (Figure 9). Additionally, the bottom of the drum appears to be bowed. Container #16 appears to be breached near the seam on the bottom of the drum (Figure 10). Some product

[24] Some of the original markings on the bottom of the steel drum was illegible as indicated in Table 3, but it appears that two of the drums were originally manufactured in 2022.

released from Container #16 following the crash, however the actual volume of product released could not be determined.

Figure 9. Photo showing damage to steel drum (Container #16).

Figure 10. Close-up photo of steel drum (Container #16) damage showing breach location.

The other three steel drums were intact and did not release product post-accident. The drums exhibited signs of physical damage including dents, scuffs and scratches.

5.3 Composite Intermediate Bulk Containers

The UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), 8, PG II was contained in two composite IBCs with a rigid plastic inner receptacle and outer steel cage on a steel pallet suitable for Packing Group II or III liquid hazardous materials, as shown in Table 4.[25,26] The two composite IBCs identified as Container #1 and Container #2 were manufactured by Mauser Packaging Solutions (Mauser) in June 2024, using the original steel cage and pallet from Schultz Container Systems provided with a new inner receptacle manufactured by Mauser (Figure 11). The composite IBCs were stack tested to 3800kg, had a tare mass of 55kg, rated capacity of 1041L at 20°C (68°F), and were gauge pressure tested to 70kPa. Both composite IBCs last underwent a leakproof test in June 2024, at which time they were also inspected. Both composite IBCs had a Class 8 Corrosive label, and UN2735 identification number affixed.

Table 4. List of Composite IBCs involved in crash

Container #	Product	Container Type	UN Marking	Manufacturer	Reconditioned	Post-Accident Condition
1	UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), 8, PG II	Composite IBC w/ rigid plastic inner receptacle and outer steel body	31HA1/Y/6-24/USA/AA3964/3800Kg 1700Kg/1041L/55kg/70KpA/6-24/6-24	Mauser Packaging Solutions	Y- 2024	intact
2	UN2735 Amines, Liquid, Corrosive, N.O.S. (Monoisopropanolamine), 8, PG II	Composite IBC w/ rigid plastic inner receptacle and outer steel body	31HA1/Y/6-24/USA/AA3964/3800Kg 1700Kg/1041L/55kg/70KpA/6-24/6-24	Mauser Packaging Solutions	Y- 2024	punctured

[25] 31HA1/Y/6-24/USA/AA3964/3800Kg 1700Kg/1041L/55kg/70KpA/6-24/6-24
[26] 49 *CFR* Part 178.703, Marking of IBCs details the require markings manufacturers are to use.

Figure 11. Photo of composite IBCs involved in crash.

One of the two composite IBCs was found to be breached post-crash. The rigid plastic inner receptacle of Container #2 was punctured on the right, rear side near the top of the receptacle and appeared to be bowed (Figure 12 and Figure 13).[27] The steel cage and pallet surrounding the inner receptacle exhibited signs of physical damage. Some product appeared to have been released from Container #2 based on the amount of product recovered from the IBC and transferred to a replacement IBC by Republic Services during post-crash cleanup (Figure 14). Some amount of product was released from the damaged container, however the actual volume of product released could not be determined.

[27] Orientation: looking from front of IBC when valve is present.

Figure 12. Photo showing damage to composite IBC (Container #2).

Figure 13. Close-up photo of composite IBC (Container #2) damage showing breach location.

Figure 14. Photo of replacement composite IBCs where the contents of Container #1 and Container #2 were transferred.

The inner receptacle of Container #1 was not breached; however, it was found to be bowed, like Container #2. The steel cage and pallet surrounding the inner receptacle exhibited signs of physical damage, like that witnessed on Container #2 (Figure 15). No product is believed to have been released from Container #1.

Figure 15. Photo showing frame damage to composite IBC (Container #1).

5.4 Plastic Drums

The UN2586 Aryl Sulfonic Acids, Liquid, 8, PG III were contained in nine non-removable head plastic drums, suitable for Packing Group II or III liquid hazardous materials with a specific gravity lower than either 1.4 or 1.9, depending on the drum, as shown in Table 5. The drums were tested to a hydrostatic pressure of either 100 kPa or 150 kPa, depending on the drum. Each of the nine plastic drums was originally manufactured in 2023 (Figure 16). Six of the plastic drums (Container #9, Container #11, Container #12, Container #13, Container #14, and Container #15) were manufactured by Shultz Container Systems, Inc., Perrysburg, Ohio. Two of the plastic drums (Container #16 and Container #18) were manufactured by Mauser USA, LLC,

East Brunswick, NJ. One of the plastic drums (Container #10) was manufactured by Greif Packaging LLC, Delaware, OH. Each of the nine drums were reconditioned and leakproof tested in 2024 by Industrial Container Services, LLC, Cincinnati, Ohio. Each of the plastic drums had a Class 8 Corrosive label and UN2586 identification number affixed.

Table 5. List of Plastic Drums involved in crash

Container #	Product	Container Type	UN Marking	Manufacturer	Reconditioned	Post-Accident Condition
11	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	*inaccessible due to overpack	Schutz Container Systems, Inc, Perrysburg, OH	*inaccessible	leaking
14	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.9/150/23/USA/M4127	Schutz Container Systems, Inc, Perrysburg, OH	Y- 2024	intact
18	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.4/100/23/USA/M4895	Mauser USA, LLC, East Brunswick, NJ	Y- 2024	intact
12	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.9/150/23/USA/M4127	Schutz Container Systems, Inc, Perrysburg, OH	Y- 2024	intact
13	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.9/150/23/USA/M4127	Schutz Container Systems, Inc, Perrysburg, OH	Y- 2024	intact
16	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1W/Y1.9/100/23/USA/M4895	Mauser USA, LLC, East Brunswick, NJ	Y- 2024	intact
9	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.4/150/23/USA/M4127	Schutz Container Systems, Inc, Perrysburg, OH	Y- 2024	intact
10	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.9/150/23/USA/GBC	Greif Packaging LLC, Delaware, OH	Y- 2024	intact
15	UN2586 Aryl Sulfonic Acids, Liquid, 8, PGIII	Non-removable head plastic drum	1H1/Y1.4/150/23/USA/M4127	Schutz Container Systems, Inc, Perrysburg, OH	Y- 2024	intact

Figure 16. Photo of plastic drums involved in crash.

One of the nine plastic drums (Container #11) was found to be leaking post-crash. Container #11 did not appear to be breached; however, the drum was secured in overpack by the Republic Services (response contractor) post-crash, so it was accessible for visual inspection (Figure 17). The container was positioned upright in the overpack and no product released from the drum in the overpack. The other eight plastic drums were intact but exhibited signs of some physical damage consisting mainly of surface scuffs and scratches. Some product was reported to have released from Container #11, however the actual volume of product released could not be determined.

Figure 17. Photo showing damaged plastic drum (Container #11) in overpack.

6.0 Cargo Loading and Securement

6.1 Brenntag Procedures

Brenntag addresses load securement for all its facilities under its *Load Securement* Standard Operating Procedure (SOP),[28] which was issued on February 9, 2024.[29] The purpose of the SOP is to describe the recommended practices for loading and securing packages, drums, and totes on their flatbed or van trailers for safe transportation in compliance with Title 49 *Code of Federal Regulations* (*CFR*) §393.100–106 and for appropriately segregated according to 49 *CFR* §177.848(e). According to the SOP:

> *Improper loading and inadequate load securing, pose extreme risk of exposure to hazardous materials and the potential for severe financial losses. All employees involved in loading and transporting product have an obligation to understand and comply with the components of this procedure for load securement, and to ensure safe transportation of all products.*

The SOP specifies that warehouse personnel are responsible for becoming familiar with all load-securing equipment for operation and application, as well as for following recommended practices.

In terms of load securement, the procedure specifies that load securement measures be applied every second pallet row (or 8 feet), at a minimum, but caveats that circumstances may dictate greater frequencies. In the case where no dunnage is used, the procedure specifies that load securement measures should be applied after every row of totes. Additionally, in the case where void space is used to distribute weight, the procedure specifies that an E-Track bar and ratchet strap be applied forward of the void and that an E-Track bar also be applied behind the void before the next row of cargo.

With regards to singling out totes or pallets of material, the SOP states that singling out such materials in the center of the trailer should be avoided. It goes on the specify that "Best Practice" is to secure a single tote or pallet to one side of the

[28] Refer to the Brenntag Load Securement SOP in the docket for this investigation.
[29] Brenntag Standard Operating Procedure Instruction #6020.003 (Rev. 0). This SOP was developed following Brenntag's attendance at an Annual Cooperative Hazardous Materials Enforcement Development (COHMED) Conference. Prior to the issuance of this procedure, the load securement procedures were included in the HM-126F and HM-181 training and the Brenntag training "huddles" in place for over 25 years.

trailer with two ratchet straps, or to incorporate the use of dunnage on one side of the pallet and then use an E-Track or ratchet strap to secure the row. The procedure states that "single drums must be secured to the wall utilizing a ratchet strap."

Lastly, the SOP states that "[t]wo ratchet straps should be applied behind the final row of product; the van trailer doors, alone, are not sufficient securement."

In addition to the Brenntag *Load Securement* SOP, the company's *Customer Pickups/Loading/Refusing Loading* SOP,[30] which was issued in September 2015, also includes cargo loading procedures. The stated objective of this procedure is to ensure that product picked up by a customer or carrier arrives at its destination safely. The SOP instructs users to ensure that containers are "loaded tightly to minimize motion between containers." The procedure also specifies that the load is "properly blocked and braced" in accordance with *49 CFR §177.834(a)*.

6.2 Brenntag Training

Brenntag requires its employees involved in loading hazardous materials cargo to complete Department of Transportation (DOT) HM-126F and DOT HM-181 training.[31,32] HM-126F training is intended to teach these individuals how to safely handle, package, and transport hazardous materials. HM-181 is basic hazmat employee training that teaches individuals how to identify and label hazardous materials and prepare packages for transportation. Brenntag requires employees to complete the initial training within 60 days of employment, and refresher training every two years. Brenntag provides this training to its employees through classroom learning and team huddles.[33]

6.3 Federal Regulations

The Federal Motor Carrier Safety Administration (FMCSA) Regulations found in 49 *CFR* §393.100–114 outline the general requirements for cargo securement on commercial motor vehicles to prevent against loss of load and shifting of load. The regulations outline the performance criteria for tiedown assemblies and other fastening devices used to secure cargo, standards for cargo securement devices and

[30] Refer to the Brenntag Customer Pickups/Loading/Refusing Loading SOP in the docket for this investigation.
[31] Refer to the Brenntag Driver Safety/DOT Training/Railcar Training SOP in the docket for this investigation.
[32] Refer to the Brenntag HM-126F and HM-181 Training Presentation in the docket for this investigation.
[33] Refer to the Brenntag Team Huddle (2023) in the docket for this investigation.

systems, general requirements for securing articles of cargo, requirements for determining working load limits of tiedowns, minimum number of tiedowns, and adjustability of tiedowns, and requirements for front end structures used as part of cargo securement systems. The regulations are intended to prevent against both loss of load and shifting of load.

Regarding performance criteria,[34] 49 *CFR* §393.102 requires that tiedown assemblies and other devices used to secure cargo to, or in, commercial motor vehicles must be designed, installed, and maintained to ensure that the maximum forces acting on them do not exceed the manufacturer's breaking strength under the following conditions:

- 0.8 g deceleration in the forward direction;
- 0.5 g acceleration in the rearward direction; and
- 0.5 g acceleration in a lateral direction.

The regulations specify that the means of securing cargo meet this performance criteria if the cargo is either:

- Immobilized, such so that it cannot shift or tip to the extent that the vehicle's stability or maneuverability is adversely affected; or
- Transported in a sided vehicle that has walls of adequate strength, such that each article of cargo within the vehicle is in contact with, or sufficiently close to a wall or other articles, so that it cannot shift or tip to the extent that the vehicle's stability or maneuverability is adversely affected; or
- Secured in accordance with the applicable requirements of 49 *CFR* §393.104–136.

In terms of general cargo securement, 49 *CFR* §393.106(b) states the following:

> *Cargo must be firmly immobilized or secured on or within a vehicle by structures of adequate strength, dunnage or dunnage bags, shoring bars, tiedowns or a combination of these.*

[34] The regulations also require that the devise be designed, installed and maintained to ensure that the maximum forces acting on them do not exceed the working load limit for the devices under the following conditions: (i) 0.435 g deceleration in forward direction; (ii) 0.5 g acceleration in rearward direction; and (iii) 0.25 g acceleration in a lateral direction.

Regarding the use of tiedowns, 49 *CFR* §393.110 outlines the requirements for determining the minimum number of tiedowns required to secure an article of cargo or group of articles against movement during transportation. According to the regulation when an article of cargo is not blocked or positioned to prevent movement in the forward direction by a headerboard, bulkhead, other cargo positioned to prevent movement, or other appropriate blocking devices, it must be secured by at least one tiedown for articles 5 feet (1.52 meters) or less in length and 1,100 pounds (500 kg) or less in weight, and two tiedowns if the article is either 5 feet (1.52 meters) or less in length and more than 1,100 pounds (500 kg) in weight or longer than 5 feet (1.52 meters) but less than or equal to 10 feet (3.04 meters) in length, irrespective of the weight. In the case where an article of cargo is blocked, braced, or immobilized to prevent movement in the forward direction it must be secured by at least one tiedown for every 3.04 meters (10 feet) of article length, or fraction thereof.

49 *CFR* §393.114 provides performance requirements for front end structures used as part of a cargo securement system. The requirements found in this section of the regulations are applicable to commercial motor vehicles transporting articles of cargo that are in contact with the front end structure of the vehicle. According to the regulations the front end structure must either extend 4 feet above the floor of the vehicle or to a height which blocks forward movement of any item or article of cargo being carried on the vehicle, whichever is lower, and must have a width at least equal to the vehicle or which blocks forward movement of any article of cargo being transported on the vehicle, whichever is narrower. The regulations also contain specific strength and penetration requirements for front end structures, and allowance for substitute devices so long as the devices are at least as strong as and provide protection against shifting articles of cargo at least equal to a front end structure which conforms to those requirements.

In addition to the FMCSA Regulations, 49 *CFR* §177.834 of the Hazardous Materials Regulations (HMR) outlines general requirements for loading and unloading hazardous materials for transportation by public highway. With regards to load securement of hazardous materials packages on a commercial motor vehicle, 49 *CFR* §177.834(a) states:

> *Any package containing any hazardous material, not permanently attached to a motor vehicle, must be secured against shifting, including relative motion between packages, within the vehicle on which it is being transported, under conditions normally incident*

to transportation. Packages having valves or other fittings must be loaded in a manner to minimize the likelihood of damage during transportation.

The HMR does not provide any specific criteria for how the packages should be secured in or on the motor vehicle, however 49 CFR §177.804 states the motor carriers must comply with the FMCSA Regulations found in 49 CFR Parts 390 through 397. The HMR also states that no carrier may transport, or cause to be transported, a hazardous material unless each hazmat employee who will operate a motor vehicle has been trained in the applicable requirements of the FMCSA Regulations and the procedures necessary for the safe operation of that motor vehicle. The regulation also outlines specific subject areas that should be included in the driver training.

6.4 Industry Standards

The North American Cargo Securement Standard was originally published in May 1999. The standard was the result of a comprehensive research program conducted by the Federal Highway Administration (FHWA) and Canadian Council of Motor Transport Administrators (CCMTA) to evaluate U.S. and Canadian cargo securement regulations; the motor carrier industry's best practices; and recommendations presented during a series of public meetings involving U.S. and Canadian industry experts, Federal, State and Provincial enforcement officials, and other interested parties.[35] On December 19, 2000, the FMCSA published a notice of proposed rulemaking to adopt rules based on the North American Cargo Securement Standard Model Regulations. Then, on September 27, 2002, the FMCSA published a final rule to revise the regulations concerning protection against shifting and falling cargo for commercial motor vehicles, based on the standard.[36] The North American Cargo Securement Standard Model Regulations was last revised in May 2012.

Canada has a set of standards called the National Safety Code (NSC). The NSC is a set of 16 standards developed by the member jurisdictions of CCMTA in consultation with the motor carrier industry to ensure road safety and facilitate the safe and efficient movement of people and goods across Canada.[37] It is considered a comprehensive code of minimum performance standards for the safe operation of both passenger and commercial vehicles used by Canadian provinces and territories

[35] https://www.fmcsa.dot.gov/regulations/development-north-american-standard-protection-against-shifting-and-falling-cargo
[36] FMCSA Docket No. FMCSA–97–2289
[37] https://www.ccmta.ca/en/national-safety-code

as the cornerstone of their commercial vehicle regulatory framework. The standards are intended to be adopted by reference into jurisdictional regulation or mirrored in provincial and territorial laws. NSC Standard 10, *Cargo Securement,* applies to any vehicle transporting cargo on a highway that exceeds a registered gross vehicle weight of 4,500 kilograms (10,000 pounds). The requirements found in the standard align with those contained in the North American Cargo Securement Standard Model Regulations.

6.5 Hazardous Materials Cleanup

The cleanup of the accident scene was conducted by Republic Services, ES under the direction of the Ohio Environmental Protection Agency (EPA).[38]

[38] Refer to the Republic Services, ES Incident Report in the docket for this investigation.

E. DOCKET MATERIAL

Hazardous Materials Attachment –	Screenshots from Brenntag Loading Dock Video
Hazardous Materials Attachment –	Brenntag Shift Supervisor interview
Hazardous Materials Attachment –	Bill of Lading
Hazardous Materials Attachment –	Safety Data Sheet (SDS) - Methanol Solution
Hazardous Materials Attachment –	Safety Data Sheet (SDS) - Flammable Liquids, N.O.S. (Acetone, Toluene)
Hazardous Materials Attachment –	Safety Data Sheet (SDS) - Amines, Liquid, Corrosive, N.O.S.
Hazardous Materials Attachment –	Safety Data Sheet (SDS) - Aryl Sulfonic Acids, Liquid
Hazardous Materials Attachment –	Brenntag Load Securement SOP
Hazardous Materials Attachment –	Brenntag Customer Pickups/Loading/Refusing Loading SOP
Hazardous Materials Attachment –	Brenntag Driver Safety/DOT Training/Railcar Training SOP
Hazardous Materials Attachment –	Brenntag HM-126F and HM-181 Training Presentation
Hazardous Materials Attachment –	Brenntag Team Huddle (2023)
Hazardous Materials Attachment –	Republic Services, ES Incident Report

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