



Close Call Incident  
Indianapolis Fire Department  
January 27, 2015

**SIIT TEAM  
INVESTIGATION**



Close Call Incident 01272015

**SIIT**

**Lessons Learned**



The following is a portion of the IFD Significant Incident Investigation Team’s report concerning the CNG Propelled Republic Services Garbage truck explosion on January 27, 2015. This incident has been deemed a “near miss” or “close call”.



A fire somehow started in the “Hopper Body” section of the garbage truck transferring heat to the CNG tanks heating them up to the point of an explosion. Some information from the report has been removed that was found to be of no value in a training aspect; i.e. company names and contacts, etc.



The IFD Significant Incident Investigation Team is a hand selected group of firefighters and civilian employees of IFD. The members are selected from different divisions of the department based on their experience and areas of expertise.



The team is tasked with assisting IFD and other agencies in investigating incidents that have significant impact on the department or the potential for serious injury or death (close call/near miss) .



The IFD SIIT Team was specifically requested by the Chief of Operations to investigate this incident.

The ultimate goal of the team is to look at the circumstances of this incident and assist IFD personnel in understanding what happened and what can be done to prevent similar incidents in the future.



**SIIT 1.27.15**

## **SIIT Chief**

**Battalion Chief Scott Isaacs, Safety 6C**

## **Investigation Team** **Members**

**Lt. Mark Nicholson, Bat4C XO,  
Team Leader**

**Captain Jim King, IFD Fire Training**

**Battalion Chief David Kelley, IFD  
EMS**





# SIIT 1.27.15 Outline

1. Introduction
2. Incident Information
3. Response
  - A. RMS/Dispatch, Enroute
  - B. Apparatus
  - C. On-Scene
4. Incident Information/Details
5. Code 700



# SIIT 1.27.15 Outline

6. Incident Outcome
7. Run Report
8. SIIT Initiated
9. SIIT Investigation
10. Findings
11. Contributing Factors
12. SIIT Conclusions
13. Recommendations/Report Submitted



# Incident Information

Date: Tuesday morning  
January 27th, 2015

Time: 05:32:14 hours

Incident # I 150112189

Address: 86<sup>th</sup> & Westfield  
Blvd (1498 East 86<sup>th</sup>)  
8502 Westfield actual

Type: Truck Fire

Shift: B



# Incident Information

A call was received by 911 from Ace Hardware stating that a trash truck was on fire in the area of 86<sup>th</sup> and Westfield Boulevard.

The initial dispatch was Engine 6.



# Incident Information

Engine 6-B was dispatched to a report of a truck fire in the area of 86<sup>th</sup> Street and Westfield Boulevard. Upon arrival Engine 6 found a commercial garbage truck with a fire in the trash hopper. The driver informed the crew that the “gas tanks” were located on top of the truck.

Engine 6 deployed an 1 ¾” hand-line using tank water to cool/extinguish the fire. A 3” supply-line was established across Westfield Boulevard.



# Incident Information

Ladder 6 was requested to assist. Upon arrival Ladder 6 set up the aerial device for an elevated master-stream. A 5" supply-line was established to Ladder 6. Soon after Ladder 6 had begun to spray water onto the garbage truck the "gas tanks" exploded.

The explosion sent several of the five tanks in various directions and shrapnel in 360 degrees.



# Incident Information

A firefighter from Engine 6 was struck by debris and knocked to the ground. He received only minor injuries and would later be taken to the clinic as a precaution.



# Incident Information

One of the tanks traveled nearly a quarter-mile to land in front of a nearby school. Safety 2 and Battalion 2 were requested and dispatched. Hazardous Materials team 44 was requested and dispatched.

The fire was extinguished and run-off contained without further incident.





# Incident Information

The garbage truck sustained significant damage from both the explosion and fire.



# Response

Engine 6	05:33:19 hours
Ladder 6	05:45:59 hours
Safety 2	06:08:00 hours
Battalion 2	06:11:52 hours
Haz-Mat 44	06:32:07 hours
(Engine/Tactical 44)	



# Response

- 05:33 Dispatch receives call from Ace Hardware stating that they could see a truck on fire
- 05:33 Engine 6 assigned/dispatched to a report of a truck fire/Code 810
- 05:35 Engine 6 Responding
- 05:35 Incident Upgraded to Small Spill/Code 822
- 05:38 Engine 6 On-scene 8502 Westfield Blvd.
- 05:45 Engine 6; "Control, this is a burning trash truck with a liquid propane tank on top. We will need Ladder 6 to come and help us."
- 05:45 Ladder 6 dispatched
- 05:47 Ladder 6 responding
- 05:49 Ladder 6 on-scene



# Response

- 05:52 Engine 6 requests IMPD for traffic control (Westfield Blvd.) laying supply lines across Westfield Blvd.  
Engine 6; "this is not a Haz-mat incident"  
Engine 6; "Control make this a working incident we have a natural gas explosion"
- 06:05 Control; "Engine 6 is this now a Haz-Mat incident?" Engine 6; "This is a trash truck that caught fire...the natural gas tank exploded we are dousing with an Aerial right now, it is still on fire, not Haz-Mat, no other units needed"
- 06:07 Engine 6 requests Safety Car
- 06:08 Safety 2 responding
- 06:12 Engine 6 requests Battalion 2
- 06:15 Battalion 2 responding
- 06:19 Safety 2 on-scene
- 06:21 Safety 2; there are lines across Westfield Blvd. blocked just south of 86<sup>th</sup> behind Steak N' Shake and Walgreens



# Response

- 06:24 Safety 2; Code 700 firefighter will advise  
06:29 Battalion 2 on-scene (assumes Command)  
Move this incident to an Ops channel and have a  
Haz-Mat team respond. (yellowish-green,  
unidentifiable run-off from incident scene to  
storm sewer towards schools)  
Assigned OPS Channel 3
- 06:29 Battalion 2; Code 700 Firefighter is Slight, NO  
medic needed
- 06:33 Engine 44 responding  
06:36 Tactical 44 responding  
06:50 Engine 44 on-scene  
06:51 Tactical 44 on-scene
- 07:16 Command (BC2); "Control Fire is out"  
07:35 Command (BC2); "Terminate Command, all  
companies will mark in when available"



# Fireground Details

## Firefighter Testimony

### **Lt. Cliff Johnson; Officer Engine 6**

On scene gave a size-up of a trash truck fire. While the engine crew stretched the front attack line he ordered the tank “dropped” and watched as the crew lobbed water into the garbage truck and directed where the water was hitting. He then talked to the driver of the garbage truck and asked if he would dump the load on the ground. The driver did not want to dump the load on the ground and then explained that there were gas bottles on top of the truck. Lt. Johnson then directed his crew to cool the tanks. He requested Dispatch for assistance from Ladder 6 to respond for a water-tower operation.



# Fireground Details

## Firefighter Testimony

### Lt. Cliff Johnson; Officer Engine 6 continued...

When they (Ladder 6) arrived he assisted them with setting up a 3" supply line to the ladder. Lt. Johnson was in front of Ladder 6 directing where to hit with the water when the explosion occurred. After the explosion he looked around and checked with the crews to see if everything was alright. He then requested Dispatch start Battalion 2 and Safety 2 after hearing that Private Blackwell had been struck by debris. The fire grew after the explosion and he ordered that the supply line be changed to a 5" hose. This was completed and the fire was then brought under control with the elevated master stream.

-end-



# Fireground Details

## Firefighter Testimony

**Engineer Quentin Beverly;  
Engine 6**

I drove to the scene and placed the apparatus about 50' away from the trash truck, flanked at a corner, set the pump and dropped the tank. I was on the pump panel for the duration of the run and was not injured.

-end-





# Fireground Details

## Firefighter Testimony

### Private Zachary Reasoner; Engine 6

I went to the front of Engine 6 to pull the front attack line and when he had water at the nozzle I played it into the top of the truck with Lt. Johnson's help directing the stream. At one point I got up next to the truck with Private Blackwell and opened the side access panel to the trash hopper and sprayed water into it. When we were told that there was gas on top of the truck we were ordered to cool the gas tanks. Upon Ladder 6 arriving we stopped using the front-discharge attack-line and went to stretch a 3" supply for the water tower operation.



# Fireground Details

## Firefighter Testimony

### Private Zachary Reasoner; Engine 6 continued...

As he and Private Blackwell were finishing stretching the supply line across Westfield Boulevard the explosion occurred sending debris their way. They ran in the opposite direction; Private Reasoner states he fell in the street and Private Blackwell went toward a ditch at the side of the road. He checked to see if everyone was alright and found that Private Blackwell had been hit with some metal from the garbage truck. He reported it to his officer. He then was ordered to assist with changing the supply line from a 3" to a 5" which he did with the firefighters from Ladder 6.

-end-



# Fireground Details

## Firefighter Testimony

### Private Michael C. Blackwell; Engine 6

According to Lt. Johnson and Private Reasoner, Private Blackwell assisted with handling hand lines and stretching supply lines throughout the ordeal. He was hit by debris at the time the explosion occurred. He was not injured seriously. He was checked out at the scene and attended to by Safety 2.

-end-



# Fireground Details

## Firefighter Testimony

### Captain Mark A. Harris; Ladder 6

Officer on Ladder 6; ordered Ladder to be raised on arrival and water supply given to them for water tower operation. He went up in bucket to control nozzle because there is no remote for nozzle on Ladder 6. While in the bucket explosion occurred, he was thrown to the floor and not hit by debris. He gave a thumbs up to crews on the ground and continued to throw water. Gave order to change to bigger supply, which was carried out by crews. He stayed in bucket until the fire was under control.

-end-



# Fireground Details

## Firefighter Testimony

**Engineer Maciej Kaszynski;  
Ladder 6**

Drove Ladder 6 to the scene and placed it next to Engine 6 on the parking lot approximately 50' away from the truck on fire, flanking the garbage truck. I went to the turn-table controls and remained there for the rest of the time.

-end-



# Fireground Details

## Firefighter Testimony

### Private Herman Kelley; Ladder 6

Assisted with setting up water supply and was next to the Ladder and Engine when the explosion occurred. He was not struck by any debris.

-end-



# Injuries/Code 700

## CODE 700/Injured Firefighter/Slight

A firefighter from Engine 6 was struck in the head and shoulder area by flying debris as a result of the explosion. He was examined at the scene and did not require transport. He was transported post-incident to the clinic. He suffered a muscle strain to his left shoulder. The injury occurred while on incident #150184046. The report was taken by Safety 2-B, Battalion Chief Wayne Smith. The firefighter in question will be on restricted duty for one week. His helmet revealed small scrapes and gouges but passed inspection. A new helmet will be issued as a precaution.



# Details

## CODE 700/Injured Firefighter/Slight

Slight Helmet damage of injured firefighter.







# Details

**Location; White's Ace Hardware**

8502 Westfield Rd, Indianapolis, IN  
46240





# Details

## Location; White's Ace Hardware

The garbage truck was located in this area facing this way.





# Details

## Location;

Looking west  
to the scene  
from the  
hydrant used  
across  
Westfield Blvd.





# Details

**Location;** Looking east where the garbage truck was parked...





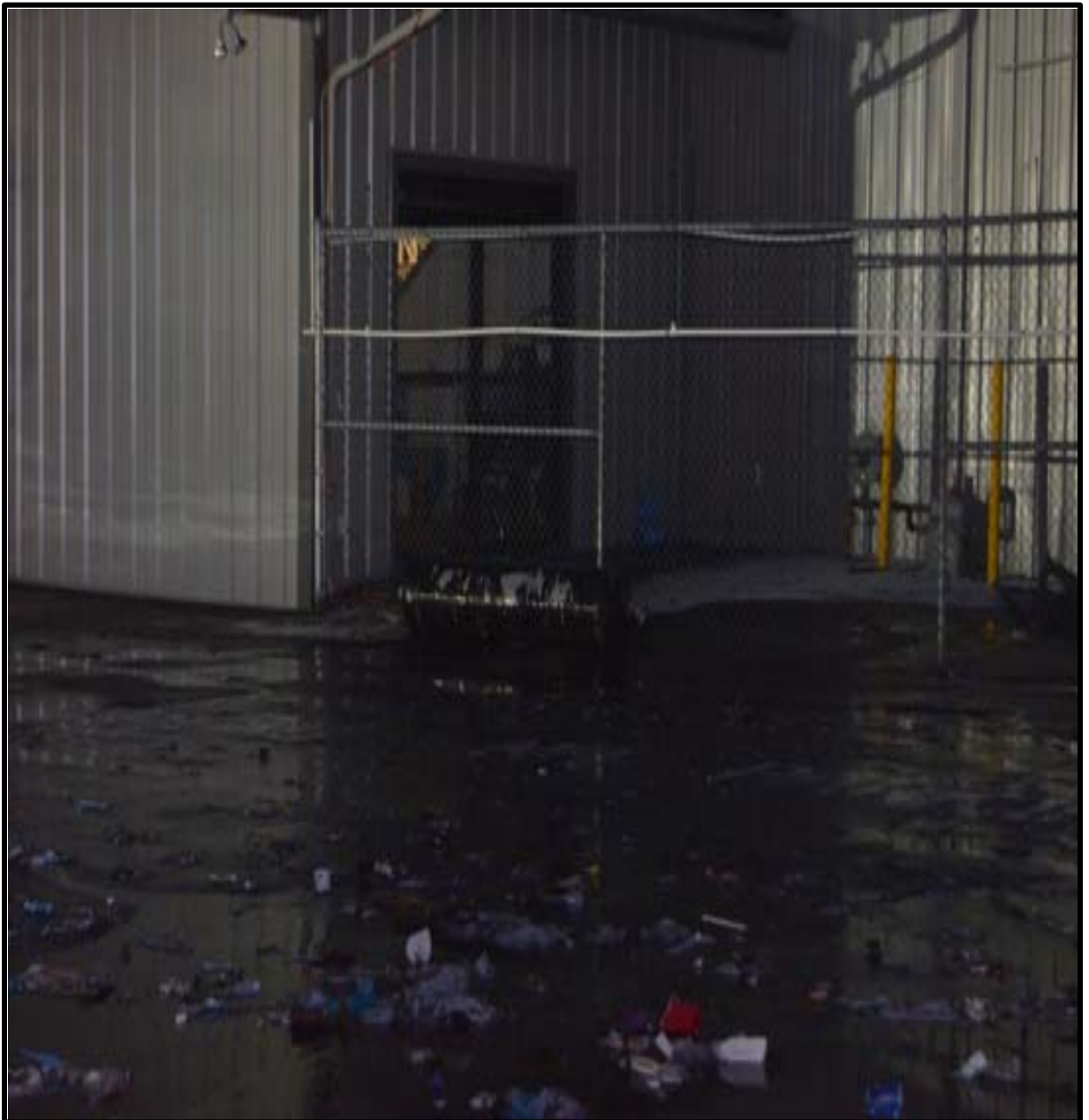
# Details

## Half-pack Freedom Front Loader

High Compaction, 36' long, 8' wide, 12' tall, 32 yard body with a 12 yard hopper



Type-4 CNG cylinder located  
several hundred feet from  
truck.



Passenger side of damaged truck at the scene.



Passenger side of truck with  
double-walled hopper  
bowed out.





Front of truck with metal cab-guard bent forward.



Cylinder located in front of  
Northview Junior High  
School after traveling over a  
quarter-mile.



Exploded Type-4 CNG cylinder at the scene.



POD cover at the scene.



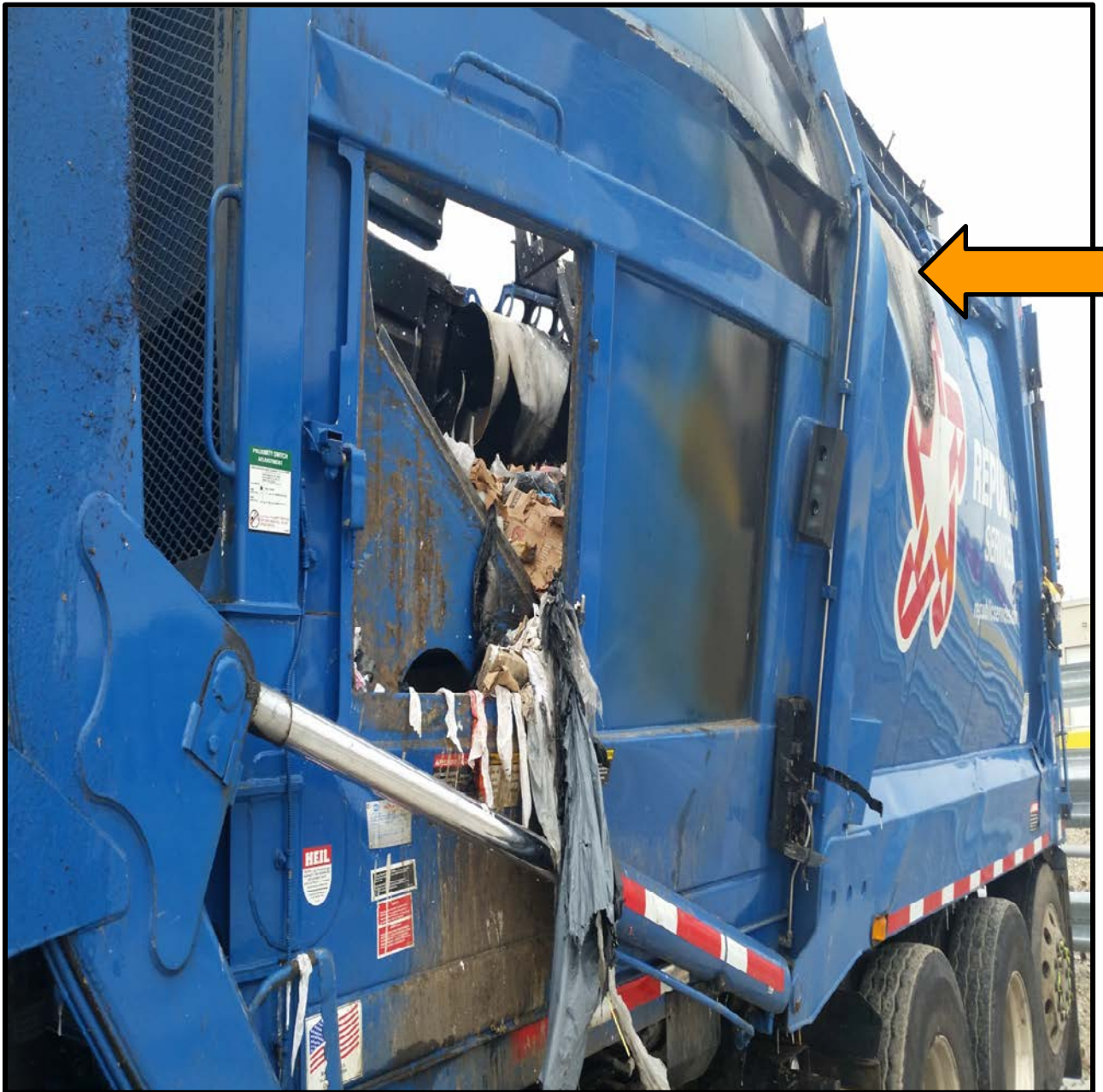
Passenger side of truck with  
double-walled hopper  
bowed out.



Driver's side of truck with double-walled hopper and steel frame bowed out.



# Driver's side damage



# Former location of CNG Cascade POD.

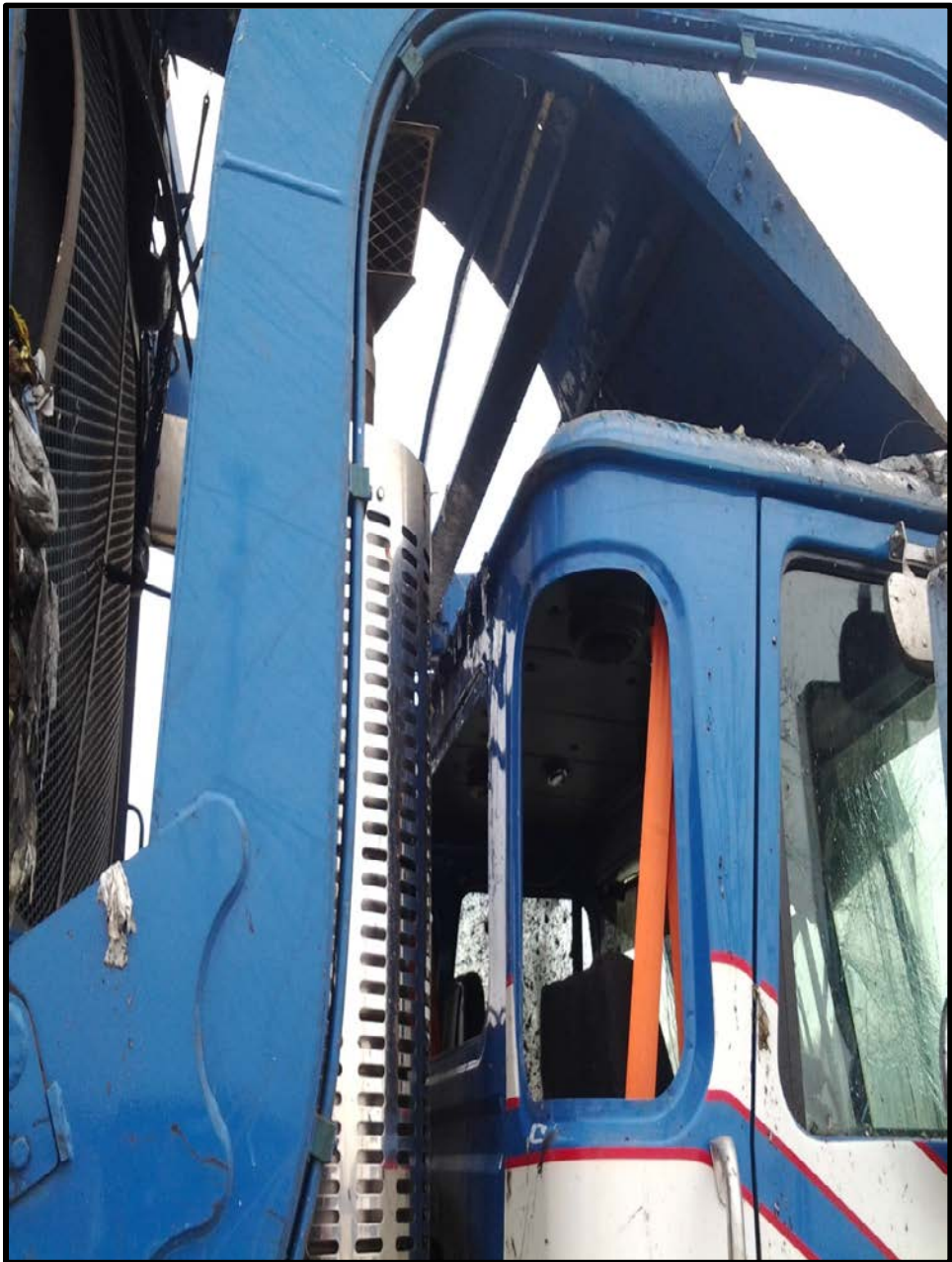




# Location of remaining frame rails of fuel cells (cascade POD)



# Cab windows shattered



# Tanks collected on-scene



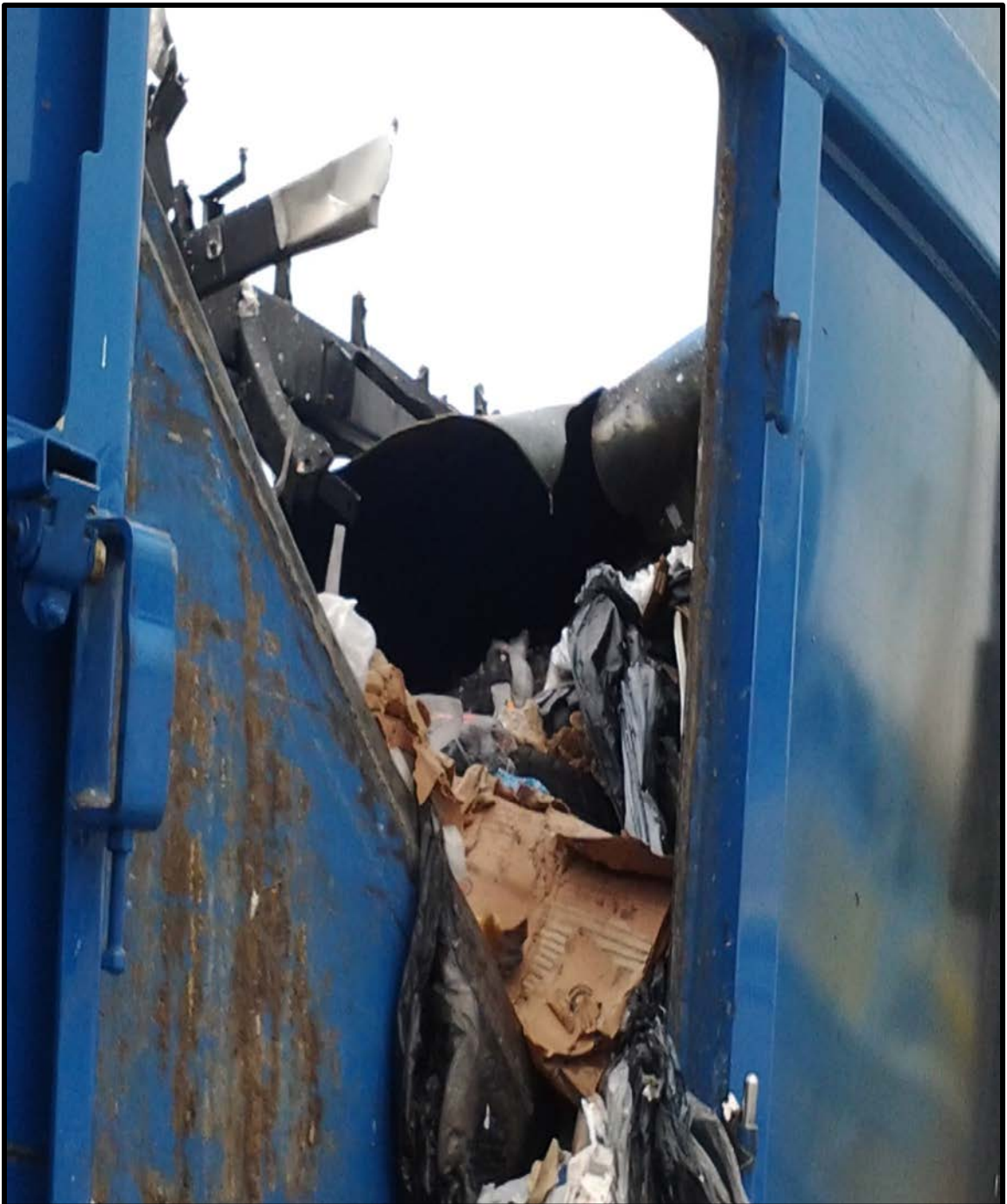
# Exploded cylinders



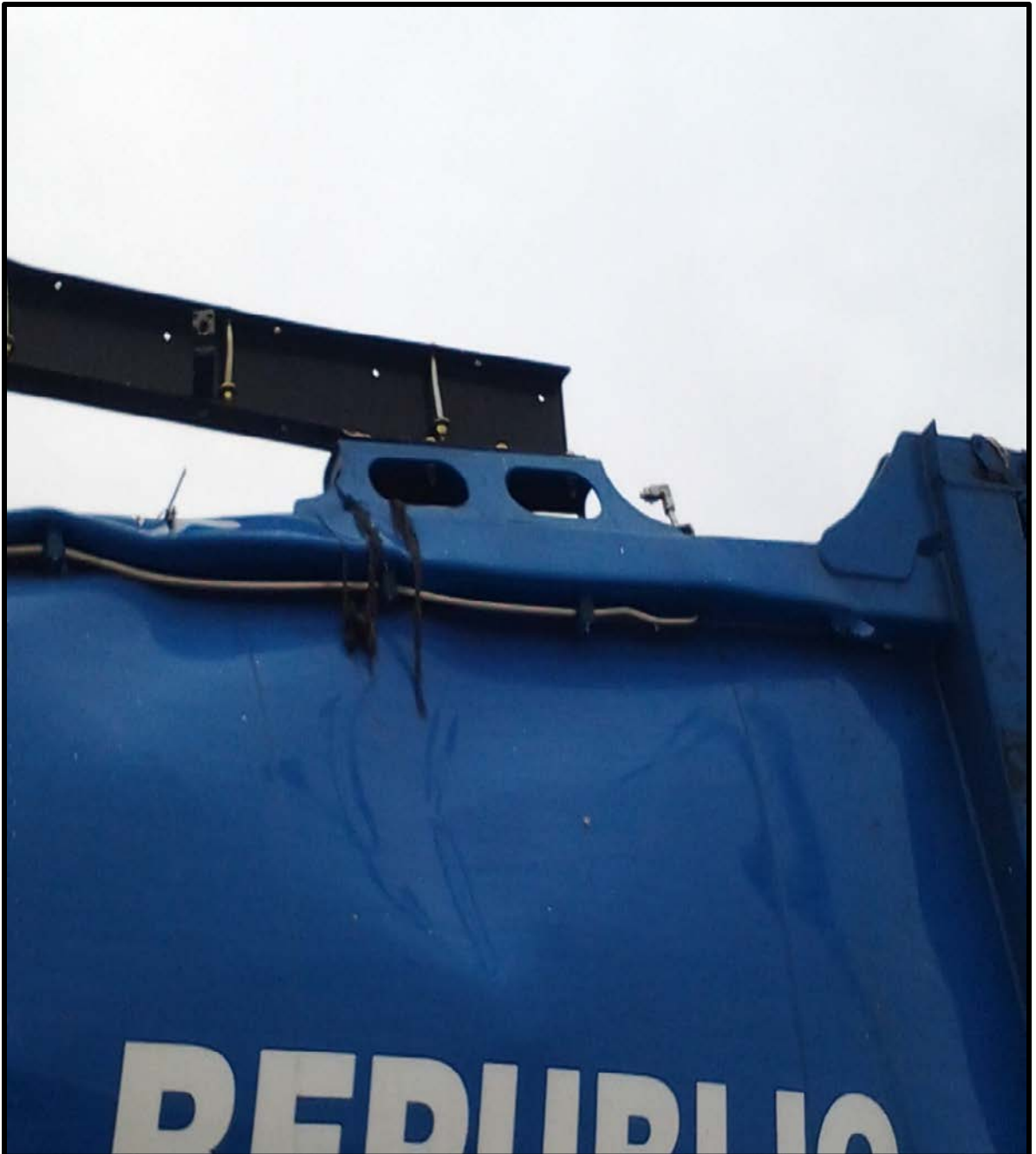
# Damaged cylinders



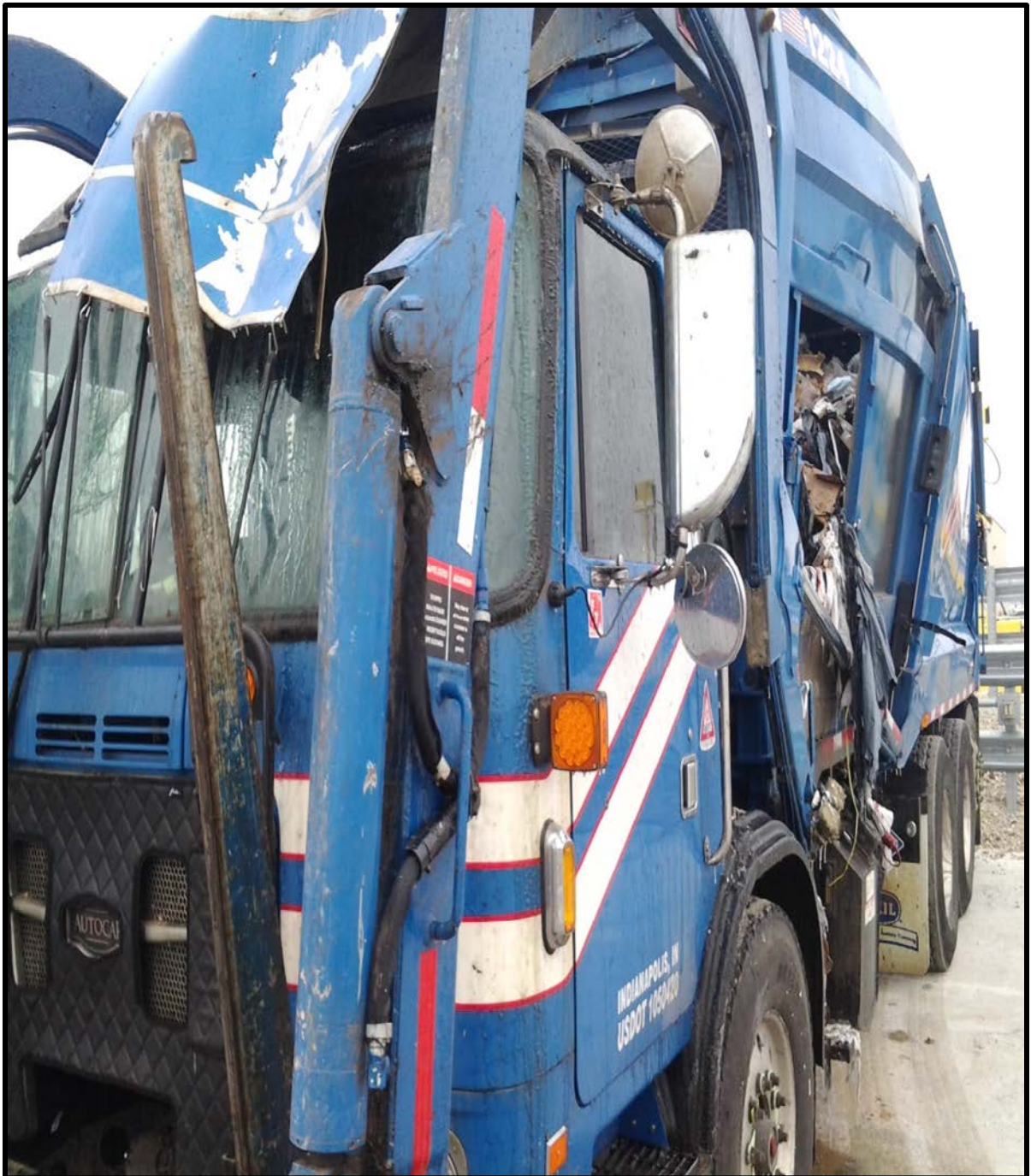
# Damaged hopper and fuel cell frame work



# Exposed fuel line and remaining fuel cell frame work



# Bowed-out body and hopper





This picture taken at the scene gives some idea as to the size/scale of the tanks that exploded.





# Incident Outcome

The fire was contained to the garbage truck's body/hopper area, however the truck sustained extensive damage due to the explosion of the CNG fuel cells. Hazmat 44 mitigated what little run-off issues were present.

A Code 700/Firefighter/Slight was noted with the firefighter in question *NOT* requiring transport. The damage to the vehicle and the potential for severe injury or death due to the nature of the incident necessitated the need for this report.



# Run Report

## Run Report Narrative;

Eg06 responded on the report of an RV/Truck fire. Eg06 found the fire to be in the trash compartment of a trash truck. Eg06 was told by the truck operator that gas tanks were located on the top of the truck. Lt. Johnson advised the truck operator to dump the load. Eg06 contacted dispatch to have L06 respond. Eg06 deployed 1 ¾" attack line to cool the tanks and attempt to lob water into the trash ben to put the fire out. A 3" supply was deployed across Westfield Blvd to supply the 1 3/4" attack line. Eg06 contracted control for IMPD to respond for traffic control. Once L06 arrived the 3" supply was replaced by a 5" supply. L06 upon their arrival set up for an aerial attack. L06 flowed water on the tanks and the trash compartment--After a few min the tanks BLEVE'D. One of Eg06's personnel was hit by flying debris. Eg06 contacted control to have Safety 02 respond. Eg06 also contacted dispatch to have BC 02 respond. Eg06 and L06 continued to extinguish the fire, and evaluate for the need for additional resources. Eg06 advised control that there was an explosion. BC02 assumed command upon its arrival, established an ops channel. Eg06 being advised by command, used two containers of oil dry to try to contain some of the run off from the incident. BC 02 called for a hazmat response team to contain waste water. Once aerial operations had extinguished the bulk of the fire, a 1 ¾" line was used to thoroughly extinguish the remaining embers in the trash compartment that were inaccessible to the aerial truck. Eg06 and L06 loaded the attack and supply lines before being advised that another gas tank was found approximately . ¾ of a mile away in front of Northview junior high school. Eg06 and L06 responded to the junior high school to assure that no hazards were present. (see incident #18092). Eg06 & L06 B-shift were relieved on scene by the C-shift.

Lt. C. Johnson



**SIIT 1.27.15**

# **SIIT Initiated**

Battalion Chief Scott Isaacs initiated the SIIT Tuesday, January 27, 2018 hours.

The SIIT investigation included visits to the scene, Republic Services of Indiana (for vehicle inspection), numerous websites and telephone conversations, photographs from both the media and fire department, witness testimony, telestaff, visual fire reporting, and Code 700 reporting files.



# Findings



## Republic Services of Indianapolis

- 3100 CNG trucks in fleet nationwide
- 97 CNG trucks in the *Indianapolis Service Fleet*



# Findings

Example of truck without damage.  
Notice cascade POD cover on top.



Example of truck after explosion with extensive damage.



# Side-by-side comparison.





# Comparison of damage .

Before

After





# Findings

**CNG** (Compressed Natural Gas)  
Fuel Properties





# Findings

## CNG Fuel Properties

- Large-scale use since 1960's
- Some 3,500,000 CNG vehicles now in operation worldwide
- Mostly in Italy, Argentina, Brazil, Pakistan, etc. as lower cost fuel
- Growing rapidly for transit operations in Europe as lower emission fuel
- Some 7,500 fill stations



# Findings

Indianapolis also has several other prominent companies utilizing CNG vehicles;

- Monarch Beverages
- Delco Foods
- Citizen's Energy

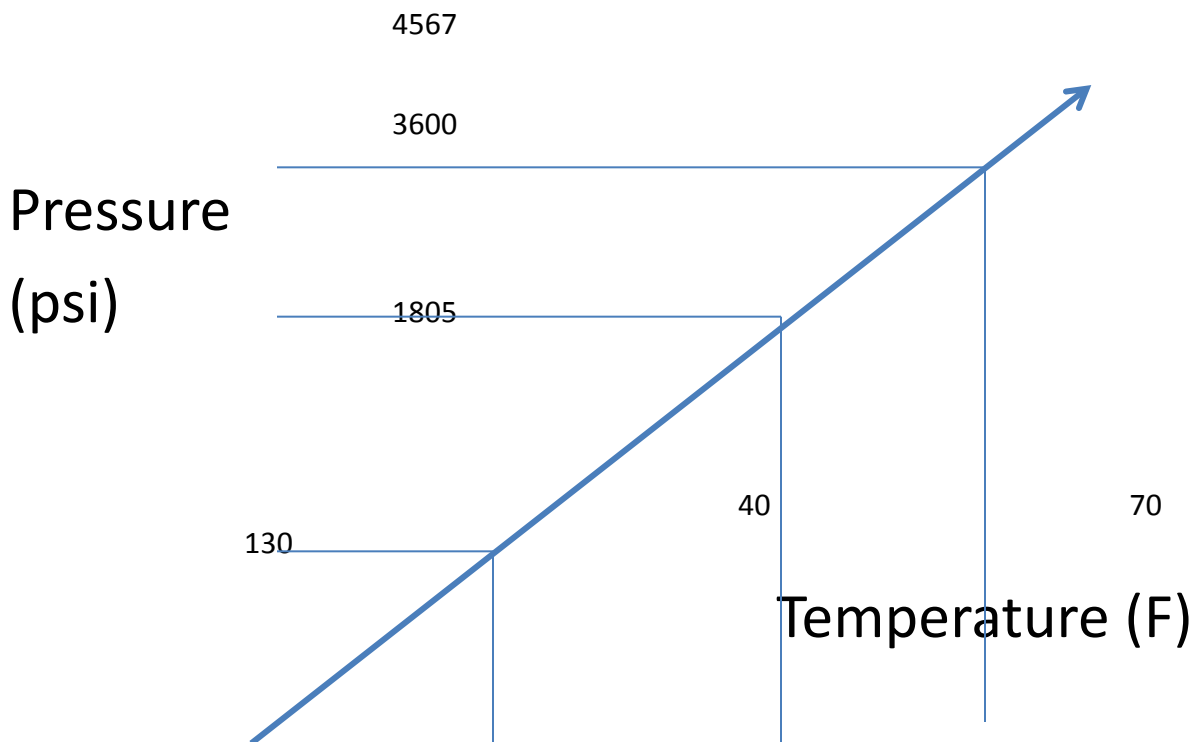




# Findings

## CNG Fuel Properties

- Typically stored at 3,600 psi at 70°F
- If ambient temperature goes up or down, pressure also correspondingly goes up or down





# Findings

## CNG Fuel Properties

Ignition Temperature 1163° (f),

5-15% Flammable range,

lighter than air

*Less pollution and more efficiency:* generally

CNG emits significantly fewer pollutants,

25% less than diesel or gasoline

(e.g., carbon dioxide (CO<sub>2</sub>), unburned

hydrocarbons (UHC), carbon

monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulfur

oxides (S

Greenhouse Gas emissions are 28% less than diesel or gasoline.



# Findings

## CNG Fuel Properties

As a comparison,

Gasoline has an

Ignition Temperature of  $495^{\circ}$  (f),

with a Flash Point of  $-50^{\circ}$  (f).



# Findings

## CNG Tanks

There are 4 types of tanks in use for CNG.





# Findings

- Type 1 - All metal (aluminum or steel)
  - Cheap but heavy
- Type 2 - Metal liner reinforced by composite wrap
  - (glass or carbon fiber) around middle
  - ("hoop wrapped")
  - Liner takes 50% and composite takes 50% of the stress (caused by internal pressurization)
  - Less heavy, but more cost



# Findings

- **Type 3 Tank Design**

Metal liner reinforced by composite wrap around entire tank (“full wrapped”)

Liner takes small amount of the stress

Light-weight, but expensive





# Findings

- **Type 4 Tank Design**

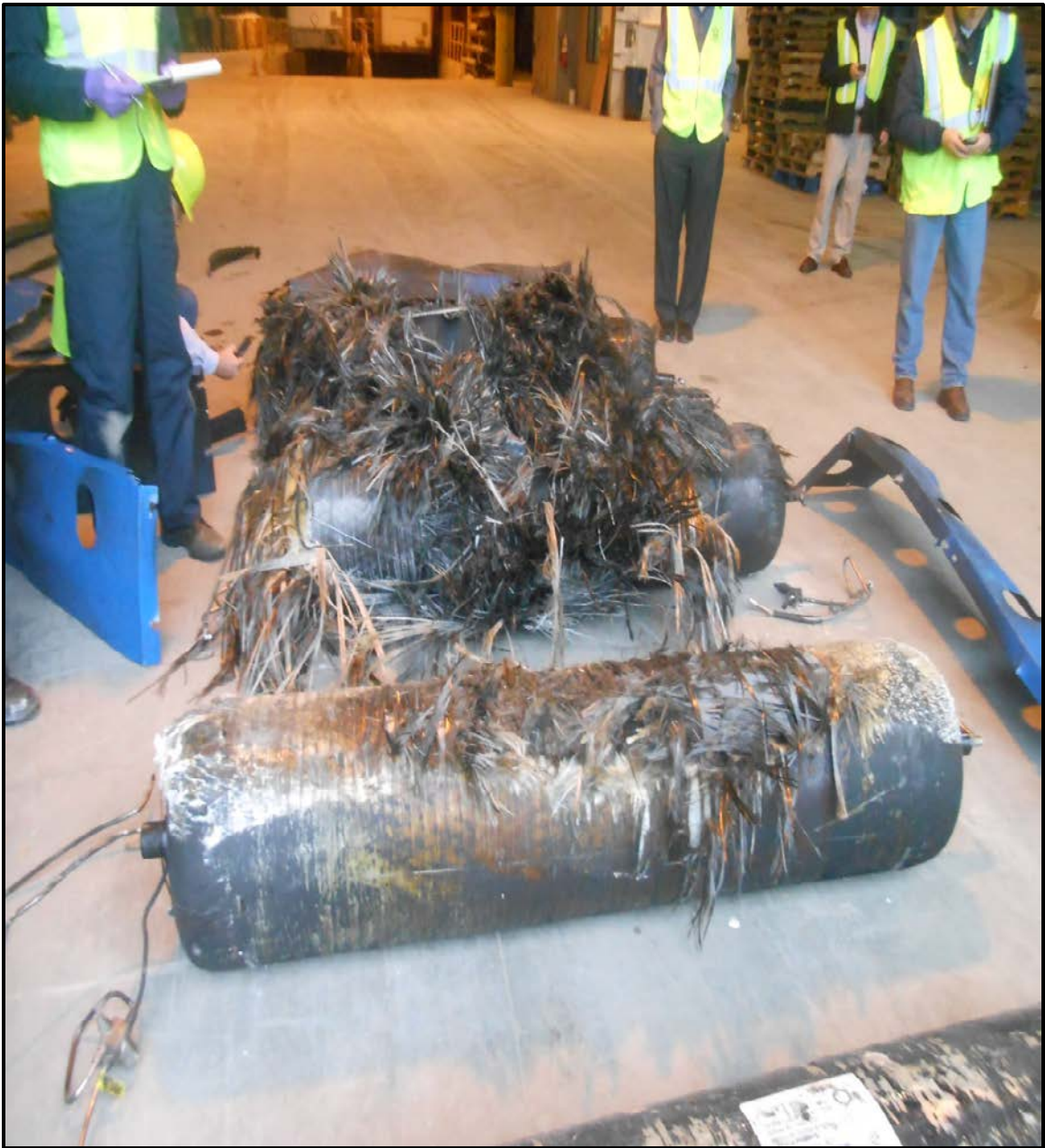
Plastic gas-tight liner reinforced by composite wrap around entire tank (“full wrapped”)

Entire strength of tank is composite reinforcement

Light-weight, but expensive

***\*NOTE...The tanks used on the Republic truck were Type 4 Tanks***

Tanks in order (front to back)  
as they were positioned on  
the truck



Exploded cylinder exposed to heat near the middle of the tank.



The two cylinders that exploded.  
Both failed near the middle of the  
tanks, it is presumed in the area of  
flame impingement.





# Shrapnel

Found in parking lot of *Everyday Paint and Wallpaper*, 8512 Westfield Blvd., to the north of scene



# 10-gauge steel sheet metal from side of cascade POD cover





10-gauge steel sheet metal  
from cascade POD cover



**NFPA 52 covers CNG fuel systems**



**NFPA 52**  
**Vehicular Gaseous**  
**Fuel Systems**  
**Code 2013 Edition**



# Contributing Factors

- The driver was unable to dump the garbage from the truck.
- The CNG (Compressed Natural Gas) Type-4 cylinders were located directly above the body of the truck where the fire was located.
- The CNG Tanks/Cascade POD are enclosed by a steel box.
- Pressure Relief Devices
  - a. Each cylinder has two “Temperature Sensitive” Pressure Relief Devices; one located at each end of the cylinder.
  - b. The location of each PRD was away from where the fire was contacting the cylinders.
  - c. The composite (spun fiberglass) cylinders did not conduct heat to the PRDs?
  - d. The PRD’s did not activate.
- Location of PRDs; by spraying into the Cascade POD from either side you will cool the temperature sensitive PRD but not the tank or material inside.
- Lack of knowledge of potential dangers associated with this type of vehicle and propulsion systems.



# Contributing Factors

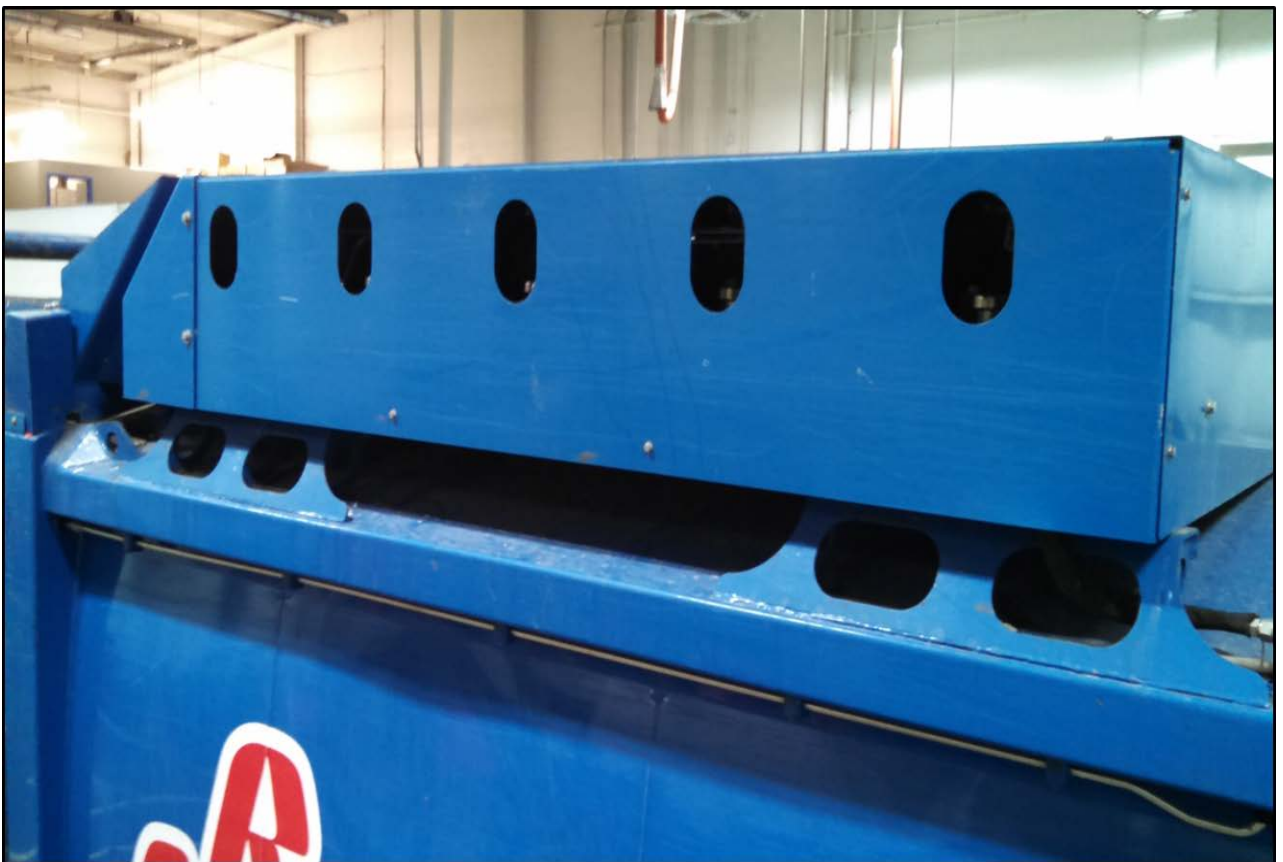
The CNG (Compressed Natural Gas) Type-4 cylinders were located directly above the body of the truck where the fire was located.





# Contributing Factors

The CNG Tanks/Cascade POD are enclosed by a steel box. This can inhibit cooling by *NOT* allowing water to reach the cylinders?





# Contributing Factors

The cylinder PRDs are located just inside the cascade cover openings. Did the water applied for cooling interfere with the PRDs ability to open?





# Contributing Factors

The top of the CNG Tanks/Cascade POD are enclosed by a steel box. This can prevent cooling?



# CNG placard (camouflaged?)







# Contributing Factors

Temperature Sensitive Pressure Relief Device (PRD) located at each end of the cylinder.





# Details

Excerpt from Agility Fuel System's CNG Operations Manual...

## Universal CNG System Operation Manual

ENP-007

Rev. H, November 2014



### Table of Contents

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# Details

## Universal CNG System Operation Manual continued...



### 1.7.3 Vehicle Fire Procedures

In the event of a CNG fire, it is imperative that the vehicle operator acts quickly:

1. Call 9-1-1.
2. Evacuate the area.
3. Get passengers out of the vehicle as quickly as possible.



# Details

## Universal CNG System Operation Manual continued...



### 1.7.3 Vehicle Fire Procedures continued...

4. Extinguish the fire using an appropriately rated fire extinguisher. A CNG fire is similar to a gasoline fire. However if the fire is not extinguished quickly the CNG cylinder pressure relief devices (PRDs) may activate to relieve excess pressure from the cylinders. PRDs typically activate between 212-220°F and will cause CNG to exit rapidly from the storage cylinders. Escaping CNG may ignite and add to the fire. DO NOT attempt to extinguish a natural gas fire with water, this will cause the gas to vaporize. Use dry powder or Purple-K-Powder.



# Details

## Pressure Relief Devices

The pressure relief devices (PRD) open at approx. 219°F (104°C) in the event of a fire to prevent over-pressurizing the fuel cylinders. The PRDs are compliant to PRD-1, and meet or exceed requirements for natural gas vehicles.



# Details

CNG propelled garbage truck  
attached to filling hoses.





# Details

CNG control valves.



# Fuel line exiting the “POD”







**SIIT 1.27.15**

# Conclusions



# Supporting History

The was little to no supporting history for this incident as it was the first fire and explosion of CNG cylinders involving a garbage truck. The only related incident involved an Elgin Brand CNG street sweeper that involved the hydraulic fluid system.



# Hypothesis

The consensus is that the explosion could not be prevented. The garbage truck hopper could not be emptied thus leading to flame/heat transfer to the CNG tanks (located directly above the fire). The garbage truck had just completed its third or fourth pick-up which meant that the hopper was empty allowing plenty of air to aid in the combustion process.



# Hypothesis

There was some confusion as to what type of fuel (Gas) was in the tanks and where the tanks were located in relation to the fire. CNG vehicles only require a small, blue, diamond-shaped CNG placard denoting the propulsion system. This was located in the right rear of the vehicle and not readily visible to the crews at hand.



**SIIT 1.27.15**

# **Lessons Learned & Recommendations**





# Recommendations

## Lessons Learned

1. In the event you respond to an incident of this type, and confirmed that it is a CNG (Compressed Natural Gas) propelled vehicle, insist the driver “DUMP” the load from the hopper.
2. Position apparatus at an angle in the area of the front corners of the garbage truck.
3. If possible, confirm how long the hopper has been on fire.
4. Attempts to extinguish the refuse on fire should only be made if there is access to the hopper through an opening.



# Recommendations

Lessons Learned continued...

5. This attack should be conducted “un-manned” if possible; deck gun or unmanned master stream.
6. Secure 500 yard area in all directions.



# Recommendations

Lessons Learned continued...

7. Personnel should be positioned behind apparatus as a shield for precaution after critical functions have been completed.
8. The cascade cover will prohibit effective cooling of the tanks if the tanks are exposed to direct flame contact.
9. Provide Department wide training concerning recognition of these types of vehicles and the dangers posed by them to responders and the public alike.





# Recommendations

Lessons Learned continued...

10. Update response protocols involving CNG propelled vehicles; especially those vehicles with CNG tanks covered by steel. The normal response of cooling fuel tanks for fear of “BLEVE” will most likely NOT work in these types of incident and can lead to serious injury or death. If there is a risk of BLEVE, and the fire cannot be extinguished soon after the fire is started, evacuate the area and prepare for exploding tanks and materials to shrapnel.



# Recommendations

Lessons Learned continued...

11. Re-enforce the need for a thorough and complete 360 scene size-up when responding to these types of incidents.



# INDIANAPOLIS FIRE DEPARTMENT

Thank You