NAR Case Studies

Paul Nony, Ph.D.

CTEH CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, LLC

What are Non-Accident Releases (NARs)?

- A hazardous materials non-accident release (NAR) is the unintentional release of a hazardous material while in transportation, including loading and unloading while in railroad possession, that is not caused by a derailment, collision or other rail related accident. NARs consist of leaks, splashes, and other releases from improperly secured or defective valves, fittings, and tank shells, and also include venting of non-atmospheric gases from safety relief devices.

Source: AAR

Where do NARs Occur?

- At the producer's facility
- In railyards
- At the customer's facility
- Everywhere else in between

How are NARs Caused?

- Pressure cars:
  - Liquid line: valve open/closure plug open or missing, valve closed/closure plug open, loose valve stem packing retainer, valve body problem
  - Vapor line: valve body problem, valve open, closure plug open
  - Pressure relief device: overloaded tank, O-ring deteriorated
  - Loose bolts on pressure plate connection to nozzle

Source: AAR

How are NARs Caused?

- Non-/Low-Pressure cars:

1. Manway: bolts loose, gasket deteriorated/misaligned/missing
2. Safety vent: frangible disk ruptured
3. Liquid Line: loose closure plug, threaded valve, or blind flange bolts; valve open or plug open
4. Fill hole: cover loose
5. Bottom outlet valve: cap loose, valve open
6. Vapor relief valve: deteriorated cap O-ring

Source: AAR

Case Study #1:
Styrene Monomer- Cincinnati, OH

- Full load of styrene monomer left on spur track for approximately 9 months.
- Neither shipper nor receiver noticed it had not been delivered.
- Car began venting through the PRD resulting in evacuations of neighborhoods and businesses

Styrene Monomer

- Requires inhibitor to prevent spontaneous polymerization
- Common inhibitors are tert-butylcatechol (TBC) and hydroquinone
- Inhibitors only slow the reaction, they do not prevent it
- Inhibitor consumption begins soon after initial mixing

Styrene Monomer

- Venting at the PRD is an indicator of product polymerization inside the rail car
- The temperature inside the rail car will rise as the reaction continues
- Decrease in venting can mean one of two things:
  - The reaction is coming to an end, or
  - The PRD has become plugged preventing the relief of pressure within the container.

Results: Styrene Monomer Tank Car

- The venting came almost to a stop several hours into the release event
- After several nervous hours, the venting started again
- Tank temperature started to decrease indicating the slowing of polymerization
- The event ended without failure of the tank car
- The evacuation resulted in a large, multi-agency response

Case Study #2: Ammonia Rail Car, El Paso, TX

- An anhydrous ammonia rail car experienced a release from the top of the car during transit
- The car was isolated at the El Paso rail yard and inspected
- Ammonia was detected leaking from a valve on top of the car


AMMONIA, ANHYDROUS
INHALATION HAZARD
TILX 302040
TILX 30204
GATX

AMMONIA, ANHYDROUS
INHALATION HAZARD

DOT112J340W

		STATION STENCIL	QUALIFIED	DUE
TANK QUALIFICATION		TAT	2001	2011
THICKNESS TEST		TXXV	2007	2011
SERVICE EQUIPMENT		TXXV	2007	2011
PRD: VALVE	280.5 PSI	TXXV	2007	2011
LINING				
88.B.2 INSPECTION		TAT	2001	2011
STUB SILL INSPECTION		TAT	2001	2011

MENT
BOARD

ABDX ABDX	LUB NO
BLT- 1-02	

1005
2


SPECIALIZED
RESPONSE


ESS FLOW VALVE
INV 3-2007
INV 3-2007

Results: Anhydrous Ammonia Tank Car

- The source of the leak was determined to be a valve that was not closed completely
- The valve was closed and the tank car was shipped down the road after the stopped leak was confirmed

Case Study #3: HF Leak, Colton, CA

- 30-40 gallons of hydrofluoric acid were reported to have leaked from a tank car in Colton Yard, CA.
- The leak appeared to come from the bottom outlet valve of the tank car
- The product had to be transferred from the tank car on site

Case Study #3: HF Leak, Colton, CA

- The rail car was isolated near the entrance to the yard where many active tracks were in use
- The product was transferred into tanker trucks and polypropylene tanks for transport offsite
- Both the tanker trucks and the poly tanks subsequently developed leaks
- A railcar had to be brought in for the offload of the product from the Baker tanks


GATX 61360
LD LMT 205400 LB 93150 KG
LT WT 67600 LB 26150 KG NEW 4-95
HYDROFLUORIC ACID
REMOVE
SPARK TESTED 2005 RLS-1
LINED BY RLS-1 2005
1790


REPAIRING TANK
SHARP OBJECTS MUST NOT
CONTACT LINING
CAUTION
DO NOT MAKE ACID CONNECTION BEFORE
VENTING TO RELEASE PRESSURE
AVOID FLAMES


P7505
BAKER
1-800-BAKER 12
TP
Simplot
R 20
NRC

Results: HF Tanker

- Air monitoring was performed in the surrounding rail yard and community to determine potential impacts to human health

- Due to issues with the containment of the transferred product, the response was prolonged for several days

- It was later determined that the HF product was contaminated prior to initial loading of the railcar

Case Study #4:
Sulfuric Acid Tank Car, Salt Lake City, UT

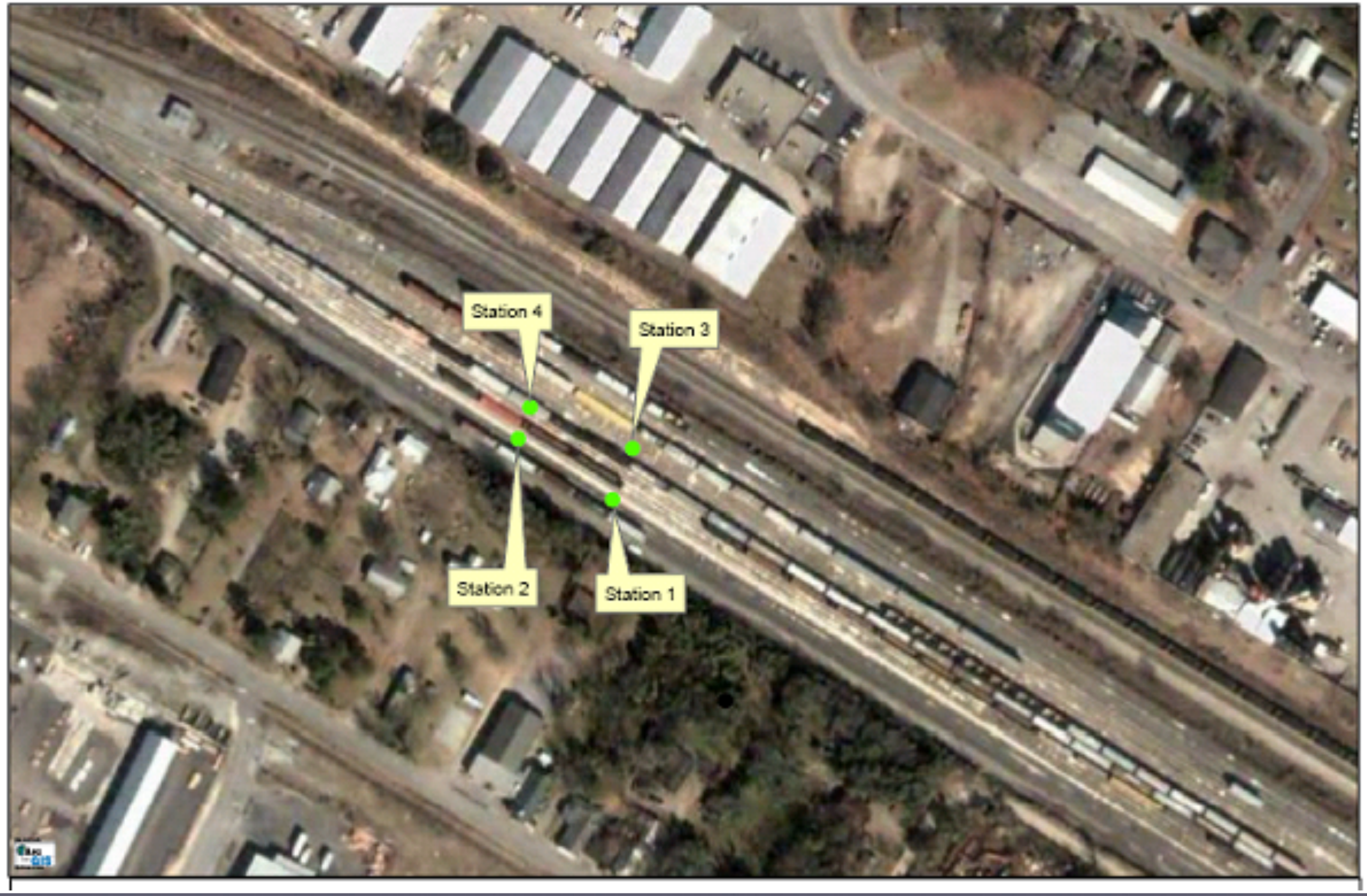
- Fully loaded sulfuric acid tank car was reported to be "reacting" in Roper Rail Yard in SLC, UT
- Concern about potential vapor exposures resulted in the evacuation of the rail yard and nearby areas
- Product was sampled and analyzed to accurately determine contents
- Analysis showed that the product contained sulfuric acid in addition to hydrofluoric, hydrochloric, phosphoric, and nitric acids

Results: Sulfuric Acid Tank Car

- It was determined that the railcar had contained different acids over time
- The acids corroded the inner liner of the tank and began reacting with the outer tank wall
- Despite a release of liquid acids, there were no significant offsite impacts due to the low volatility of the acids in solution.

Case Study #5:
HCl Tank Car Leak, Columbia, SC

- Workers reported visible liquid dripping down the side of a HCl rail car in the rail yard
- Visible vapors were reported emanating from the liquid
- Workers were evacuated from the rail yard
- Local responders evacuated residences near the rail yard


Station 4
Station 3
Station 2
Station 1

Results: HCl Railcar

- Responders determined that the rail car had been overfilled prior to shipping
- High ambient temperatures likely caused the product to expand
- Movement of the rail car caused the HCl to slosh out of the manway of the general service tank car
- Part of the product was transferred out of the car resulting in an appropriate volume for transport

Preventing NARs = Preventing Unnecessary Costs and Liability

- Most NARs start as small, manageable releases but may not end up that way
- Response decisions must be made carefully with due diligence about the equipment and the product
- Proximity is everything: potential community impacts drive the level of response resulting in greater response costs
- Collaboration between shippers, receivers, and the railroads will continue to reduce the number and impacts of NARs

Questions?

Paul Nony, Ph.D.

pnony@cteh.com

501-352-3131

CTEH CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, LLC

Toxicology Emergency Response
24-Hour Help Desk
1.866.869.2834