Best Practices for Securing Tank Cars Used to Transport Chlorine, Caustic & Hydrochloric Acid
Why should we be concerned with NARs?

SAFETY FIRST!

Preventing NARs should be a top priority to ensure protection of the public and our own personnel.
Additional costs of NARs

- Medical costs for personnel exposures
- Environmental clean-up
- On-going environmental monitoring
- Railroad fines - assessed fines and charges for operational upsets
- Disruption in facility operations
- Lost utilization of tank car
- FRA fines
- Lawsuits
- Damaged public perception
Shipper of Record

The party preparing and offering a tank car for transport becomes the **shipper of record**

*Proper securement is the responsibility of the shipper of record*
CI Transportation Incident Goals

**Long-Term:** ZERO releases

**Intermediate:** Continued reduction of transportation incidents while aiming for zero.

- Analyze 3-year cumulative periods
- Focus on top two or three causes for each product/mode
- Prioritize based on risk and/or recent efforts

**Annual:** Focused efforts based on trends identified
Chlorine Tank Car Incidents 2015-2017

Total Shipments (loaded) = 63,794
Incident Rate = 0.02%
# Hydrochloric Acid Tank Car Incidents 2015-2017

**Total Shipments (loaded) = 83,172**  
**Incident Rate = 0.09%**

<table>
<thead>
<tr>
<th>Incident Type</th>
<th>Incidents</th>
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<tr>
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<tr>
<td>Liquid Line Flange - Unsecured</td>
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<td>Air Inlet Valve - Open/Unsecured</td>
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<td>Air Inlet - Misc.</td>
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<tr>
<td>Fill Hole - Gasket Failure</td>
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<td>Rupture Disc Assembly - Misc.</td>
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<td>Premature Movement - Hose Failure</td>
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<tr>
<td>Hose/Connection Failure</td>
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</tr>
<tr>
<td>Fill Hole - Damage/Defect</td>
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</tbody>
</table>
Caustic Tank Car Incidents 2015-2017

Total Shipments (loaded) = 216,186
Incident Rate = 0.03%
Best Practices for Preventing NARs

Always use a checklist to document the leak check and securement process

Be sure procedures / checklist include the following important steps
1. Confirm quantity of product in tank car to ensure that the car is not overloaded.
Best Practices for Preventing NARs

2. Inspect valves, closures, fittings gaskets and fasteners for damage, defects or foreign matter.

<table>
<thead>
<tr>
<th>Chlorine (Pressure Car – DOT 105)</th>
<th>Hydrochloric Acid (Non-Pressure Car – DOT 111 – no insulation/jacket)</th>
<th>Caustic (Non-Pressure Car – DOT 111 – insulation/jacket/exterior heater coils)</th>
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<tr>
<td>• Liquid valves</td>
<td>• Liquid Line</td>
<td>• Liquid Valve</td>
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<tr>
<td>• Vapor Valves</td>
<td>• Air Inlet Valve</td>
<td>• Air Inlet Valve</td>
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<td></td>
<td>• Fill Hole</td>
<td>• Hinged and Bolted Manway</td>
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<td></td>
<td></td>
<td>• Bottom Outlet Valve</td>
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<td></td>
<td></td>
<td>• Top-Operating Handle for BOV (if installed)</td>
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</tbody>
</table>
Best Practices for Preventing NARs

Chlorine Tank Cars
Chlorine Tank Cars

Check valves for leaks by:

• Closing the valves
• Leave *the plugs out*
• Be sure to check all valves for leaks, even if not used during the process
• Use aqua ammonia vapor to check for leaks
Chlorine Tank Cars

Aqua ammonia leak checking tips

✓ It is recommended to use a 10-30% lab grade aqua ammonia (ammonium hydroxide) solution.

✓ Use a squeeze bottle with a tube that extends only into the vapor space of the bottle.

✓ When checking for leaks, always use fumes. Never use a liquid stream.
  – If there is a leak, the liquid will make the leak worse.
Chlorine Tank Cars

- Wait as long as possible before doing the leak check (8-24 hours suggested).
- Leave the plugs out

*This will allow the smallest of leaks to be detected*
Chlorine Tank Cars

Thoroughly inspect and clean the threads on valve inlets and plugs

- Rusty threads can create torque before sealing
- Mark threads in poor condition and contact supplier
Chlorine Tank Cars

Use of Teflon® tape on stabber pipes or plugs is not generally recommended

- Tape debris can get caught in the valve seat and threads
- Can prevent proper sealing
Chlorine Tank Cars

Known acceptable sealing lubricants that are compatible with chlorine:

- Fluorolube® grease grade GR-470 (0 to 300 °F)
- Fluorolube® grease grade GR-362 (-40 to 300 °F)
- Krytox® grade GPL-205 grease
Chlorine Tank Cars

Re-install valve plugs

• *Always use a wrench to apply plugs.*
• *Plugs MUST be tool tight.*
Chlorine Tank Cars

Check all valves again to make sure they are **completely** closed **after** installing the plugs.

*The wrench can bump the valve handle open slightly.*
Best Practices for Preventing NARs

Hydrochloric Acid Tank Cars
Hydrochloric Acid Tank Cars

Inspect and clean gaskets and fasteners on valves, closures and other fittings.

*Replace damaged or old gaskets and fasteners*
Hydrochloric Acid Tank Cars

Verify that all fasteners are tightened by using proper torquing methods (crisscross pattern)
Hydrochloric Acid Tank Cars

The use of segmented washers is recommended to help ensure proper torquing and securement of fasteners.
Hydrochloric Acid Tank Cars

Verify that all valves, closures and other fittings are closed:
• Close the valves
• Install and fasten fill hole cover
• Close/fasten all other openings to tank car

Ensure all openings to the tank cars closed, even if they were not used during loading or unloading.
Hydrochloric Acid Tank Cars

When securing HCl railcar closures and fittings, allow for rubber relaxation (creep/cold flow)

- Typical for newer rubber
- Tighten multiple times until relaxation no longer appears to be present
- One final time should be immediately prior to shipping
Hydrochloric Acid Tank Cars

- Natural Rubber Lining
- Lining/Coating alternatives for various acid car fittings
- TranZcoat Coating
- PTFE Coating
- UHMW PE Flange Faces & PVDF Coating
Hydrochloric Acid Tank Cars

Leak check all fittings. Common methods/solutions used:

• Aqua Ammonia Solution
• Bubble Leak Solution

General leak checking tip: Wait as long as possible (8-24 hours suggested) before doing the leak check.

This will allow the smallest of leaks to be detected.
Hydrochloric Acid Tank Cars

Bubble Leak Checking Tips:
• Application of solution can be any suitable method.
• Be sure to reference and follow your company’s procedures.
Hydrochloric Acid Tank Cars

*Some commercial grade bubble leak check solutions include:*

- Snoop® by Swagelok Company
- Leak-Tec® by American Gas & Chemical Co.
- Sherlock® by Winton Products Company, Inc.
- Big Blu® and Super Blu®, both by Refrigeration Technologies
- Trax by Highside Chemicals, Inc.
- D’Tec by Highside Chemicals, Inc.
Best Practices for Preventing NARs

Caustic Tank Cars
Inspect hinged & bolted manway gasket and eyebolts for damage, defects or foreign matter.
Caustic Tank Cars

Hinged & Bolted Manway Gasket Inspection

• Inspect gasket for:
  ➢ Dirt
  ➢ Debris
  ➢ Cuts
  ➢ Tears
  ➢ Gouges
  ➢ Pits
  ➢ Scratches
  ➢ Other defects

• Clean dirt and debris from gasket
• Replace gasket (in kind) if damage or defects are present
• Ensure manway cover sealing surface is clean and free from damage
• Contact your caustic supplier, if needed
Caustic Tank Cars

Hinged & Bolted Manway

Gasket Inspection

New Gasket

Damaged Gaskets
Caustic Tank Cars

Hinged & Bolted Manway Eyebolt Inspection

• Inspect eyebolt, threads, nuts and washers for:
  ➢ Dirt
  ➢ Corrosion
  ➢ Fatigue
  ➢ Cracks
  ➢ Stripping (threads)
  ➢ Other wear
• Ensure eyebolts are same diameter
• Ensure nuts are same shape
• Ensure eyebolt hinge pins are not missing or damaged
• Clean dirt and debris
Caustic Tank Cars

Cleaning Eyebolt Threads with Wire Brush
Caustic Tank Cars

Eyebolt Washer Fit

Correct washer fit

Incorrect washer fit
Caustic Tank Cars

Manway Safety Eyebolt

Safety eyebolts still in place.

Operator slightly opening manway to verify little or no pressure.

Safety eyebolt slightly loose in place with nut still attached.

All other eyebolts unthreaded from cover.

Manway Cover Handle
Caustic Tank Cars

Safety Eyebolt Inspection

Collar Style

Pin Style

Wedge Style
Replace eyebolts, nuts and/or washers if:

- Missing parts have been identified
- Eyebolts are a different size than they should be
- Nuts are a different shape than they should be (square or hex)
- Enough damage to prevent effective securement
Caustic Tank Cars

Check for manway alignment issues

Manway cover, gasket and nozzle in alignment with a good seal.
Caustic Tank Cars

Verify that all fasteners on the hinged manway are in place and tightened by using proper torquing methods.
Caustic Tank Cars

Ensure the bottom outlet valve is properly secured
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements

Internal Bottom Outlet Valve

External Bottom Outlet Valves
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

Top-Operated, Internal BOV with External Auxiliary Valve:

- Top-Operating Handle
- Internal Valve Stem
- Valve Stem Connection to Internal BOV
- External Auxiliary Valve
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

New BOV handles must be:
• Stowed separately;
• Located completely within the skid; or
• Disengaged from valve when in the closed position.

More details can be found in AAR M-1002, Appendix E, 9.1.2.8
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

Examples of Disengaging BOV Handles

Example of Detachable BOV Handle
Caustic Tank Cars

Leak check all service equipment:

• Check for leaks on all service prior to shipment, even if not used during the process.
• Wait as long as possible to check for leaks again prior to shipping.
• Ensure all fasteners are tool tight.
Caustic Tank Cars

Example of pressurizing tank car for leak check

Example of leak checking fittings with leak test solution
Caustic Tank Cars

Some commercial grade leak check solutions include:

• Snoop® by Swagelok Company
• Leak-Tec® by American Gas & Chemical Co.
• Sherlock® by Winton Products Company, Inc.
• Big Blu® and Super Blu®, both by Refrigeration Technologies
• Trax by Highside Chemicals, Inc.
• D’Tec by Highside Chemicals, Inc.
Best Practices for Preventing NARs

3. Ensure that pressure relief devices are properly secured and free of leaks

- Rupture Disc Housing
  - (Non-pressure – Non-reclosing)

- Pressure Relief Valve
  - (Non-pressure – Reclosing)

Pressure Relief Device
  - (Chlorine – Combination)
Chlorine Tank Cars

Combination Pressure Relief Devices (PRDs)

*Reclosing valve & non-reclosing rupture disc*

- Crosby (JQ-RD-375)
- Midland (A-1402, A-14377, A-14378)

**Sample Crosby Design**

**Sample Midland Design**

- Inspection (Tell-tale) Valve
- Reclosing Valve
- Rupture Disc
- Inspection (Tell-tale) Valve
Chlorine Tank Cars

Inspect PRD, including tell-tale valve, prior to shipment.

• If leak detected around bolts, tighten bolts
• If leak detected from tell-tale valve,
  – Close valve
  – Contact supplier
Hydrochloric Acid & Caustic Tank Cars

Pressure Relief Device Options

Hydrochloric Acid

Caustic

Reclosing Safety Valve

Rupture Disc Assembly
Hydrochloric Acid & Caustic Tank Cars

If the car is equipped with a rupture disc, careful inspection of the disc and its assembly are required:

- If a cable seal is in place on the rupture disc assembly, cut or remove it;
- Remove the assembly’s cap;
- Inspect both sides of the rupture disc;
- Re-apply and tighten the cap; and
- Install a new cable seal, if needed
Hydrochloric Acid & Caustic Tank Cars

Rupture Disc Inspection

Unaltered Rupture Disc

Examples of Blown or Damaged Rupture Disks

Blown Rupture Disc

Dented Rupture Disc

Dented Rupture Disc Lip

Caustic rupture discs shown for example.
Hydrochloric Acid & Caustic Tank Cars

After inspection, ensure proper assembly and securement of the rupture disc

• Ensure disc is installed with proper flow direction (non-unidirectional discs)

• Follow OEM assembly and installation instructions
Hydrochloric Acid & Caustic Tank Cars

Sample Rupture Disc Assembly Instructions for Hydrochloric Acid Tank Cars

To inspect the rupture disc and gasket:
1. Remove the top cap (Figure 1) and inspect the disc.
2. Inspect the rupture disc (Figure 2).
3. Inspect the rupture disc gasket (Figure 3). If the gasket is damaged, replace it.
4. Inspect the rupture disc assembly (Figure 4).
5. Inspect the rupture disc seal ring (Figure 5).
6. Inspect the rupture disc retaining ring (Figure 6).
7. Inspect the rupture disc protective cap (Figure 7).
8. Inspect the rupture disc protective cap (Figure 8).
9. Inspect the rupture disc protective cap (Figure 9).
10. Inspect the rupture disc protective cap (Figure 10).

To install the rupture disc:
1. Remove the top cap (Figure 11) and inspect the disc.
2. Inspect the rupture disc gasket (Figure 12).
3. Inspect the rupture disc assembly (Figure 13).
4. Inspect the rupture disc seal ring (Figure 14).
5. Inspect the rupture disc retaining ring (Figure 15).
6. Inspect the rupture disc protective cap (Figure 16).
7. Inspect the rupture disc protective cap (Figure 17).
8. Inspect the rupture disc protective cap (Figure 18).
9. Inspect the rupture disc protective cap (Figure 19).
10. Inspect the rupture disc protective cap (Figure 20).

To remove the rupture disc:
1. Remove the top cap (Figure 21) and inspect the disc.
2. Inspect the rupture disc gasket (Figure 22).
3. Inspect the rupture disc assembly (Figure 23).
4. Inspect the rupture disc seal ring (Figure 24).
5. Inspect the rupture disc retaining ring (Figure 25).
6. Inspect the rupture disc protective cap (Figure 26).
7. Inspect the rupture disc protective cap (Figure 27).
8. Inspect the rupture disc protective cap (Figure 28).
9. Inspect the rupture disc protective cap (Figure 29).
10. Inspect the rupture disc protective cap (Figure 30).

To replace the rupture disc cap:
1. Replace the rupture disc cap (Figure 31).
2. Tighten the cap (Figure 32).
3. Using the SALCO Quick Start Wrench (Figure 33), replace the component (Figure 34).
4. If the component is not a Quick Start Wrench (Figure 35), place a 1/2" flat bar into the area of the disc to free it from the cap (Figure 36).
5. DO NOT OVERTIGHTEN (Figure 37) – overtightening can damage the disc and affect performance. The ring around the disc cap is supposed to spin around (Figure 38).
6. Install the top cap (Figure 39).

11. Follow the instructions for the specific application, whether it is a tank car or another type of vessel.
Best Practices for Preventing NARs

4. Wash car down to clean off visible product to provide evidence that the car left the plant clean and secure

Hydrochloric Acid

Caustic

Clean Car

Stained Car & Service Equipment
Best Practices for Preventing NARs

5. Reduce the pressure in the car to zero, or as low as possible.

- For chlorine, less than 50 psig for return shipments is recommended.
- Extra pressure increases the possibility of a leak.
Best Practices for Preventing NARs

6. Install security measures for service equipment

- Various options
  - Protective Housings
  - Cable Seals
  - Tamper-evident bags
  - GPS

- Visual documentation (photo or video) also recommended
Chlorine Tank Cars

Security Measure Options

Protective Housing

Cable Seal

GPS Units
Hydrochloric Acid Tank Cars

Security Measure Options

- Protective Housing
- Cable Seals
- Tamper-Evident Bag
Caustic Tank Cars

Security Measure Options

Protective Housing

Cable Seals
If leaks are detected and cannot be stopped

**Do not ship the car**

- Mark the location of the leak
- Cars with active leaks prohibited for transport by DOT regulation
- FRA movement approval required if leak cannot be resolved on-site
- Unloaders, contact your caustic supplier for further instructions
Chlorine Institute Resources

Chlorine:

• Pamphlet 1 – *Chlorine Basics*
• Pamphlet 6 – *Piping Systems for Dry Chlorine*
• Pamphlet 66 - *Recommended Practices For Handling Chlorine Tank Cars*
• CLS-DVD - *Preventing Non-Accident Releases from Chlorine Railcars by Properly Securing Return Shipments*
Chlorine Institute Resources

Hydrochloric Acid:

• Pamphlet 98 – *Recommended Practices for Handling Hydrochloric Acid in Tank Cars*

• *Pamphlet 169 - Hydrochloric Acid Solution Bulk Transports Emergency Response Guidelines Handbook*

• HCLS-DVD - *Preventing Non-Accident Releases by Properly Securing Hydrochloric Acid (HCl) Railcars*

• HCL-DVD - *Safe Handling of Hydrochloric Acid*
Chlorine Institute Resources

Caustic Resources:

• Pamphlet 87 – *Recommended Practices for Handling Sodium Hydroxide and Potassium Hydroxide (Caustic) Tank Cars*

• CAUS-DVD - *Preventing Non-Accident Releases by Properly Securing Caustic Railcars*
Chlorine Institute Resources:

- Hard copy pamphlets (member and non-members fees)
- PDF copy of pamphlets – FREE for download
- Securement-related DVDs – FREE (shipping cost may apply for more than 5)
- Online videos – FREE streaming or download

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Thank You! Questions?