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Railcar Loading Incidents – Same Safety Standards for logistic operations and for process units?

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Railcar Loading Incidents

- Logistic operations like loading/unloading of railcars are routine operations in process industries
- Risk factors and considerations:
  - Loading/unloading is often operated with a high frequency (normally daily operations)
  - High volumes of hazardous substances are handled
  - A lot of manual handling is required during loading/unloading
  - Loading/unloading operations are directly linked with several hazard factors like overfill open, loading/unloading of wrong product, etc.

- Nevertheless, we see that the safety standard at loading stations is often lower than in process units
  - Lack of “state of the art-safety equipment”
  - Safety critical devices not really protected against bypassing
  - Loading personnel not always on the same qualification level as “normal operators”!
- See 2 examples on serious incidents at loading facilities!
- Check your loading facilities, could this happen as well?

Example 1: Damage of railcar loading station

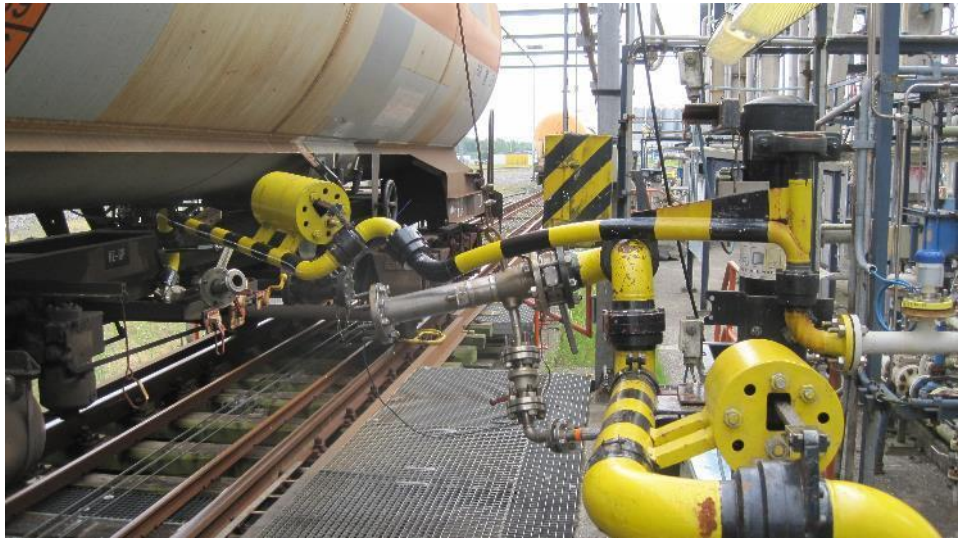
Loading Station

- Loading station for railcars with Vinyl Chloride Monomer (VCM), loading can be done at 2 stations simultaneously
- Rail tank wagon (A) was in the loading process, liquid and gas loading arms installed
- Another rail tank wagon (B) on the same track had finished loading and weighing;
- Loading operator wanted to move tank wagon (B), although this is according to the procedures not allowed.
- A transport unit (TU) is used to move the tanks and can be set to either pass under wagons or move them.
- The TU can only move when loading arm is in parking position, this triggers a safety interlock (safety contact).

Example 1: Damage of railcar loading station

What happened:

- An operator moved the safety contact and bypassed the safety system!
- To move away filled wagon B, TU needed to pass wagon A (in loading).
- TU was not set to the correct position to allow it to pass freely under the wagon A (transport hook was extended)
- When TU passed wagon A, it pulled wagon A along the track, resulting in bending the loading arms.
- Incident was spotted by operator; the emergency stop button was pressed and the system shut down into a safe state.
- Rail tank wagon A and liquid and gas loading arms were significantly damaged!
- No release of VCM or injuries were reported!



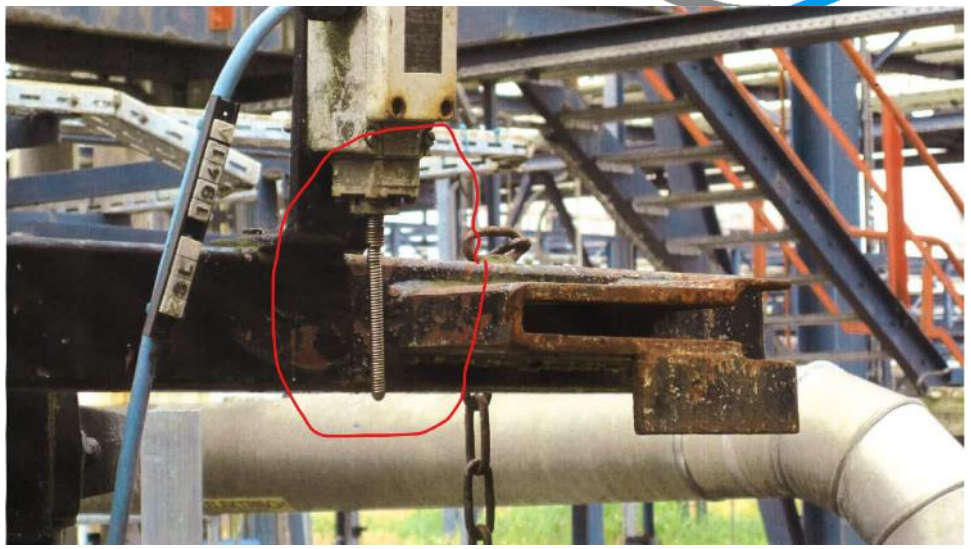
Example 1: Damage of railcar loading station

Why:

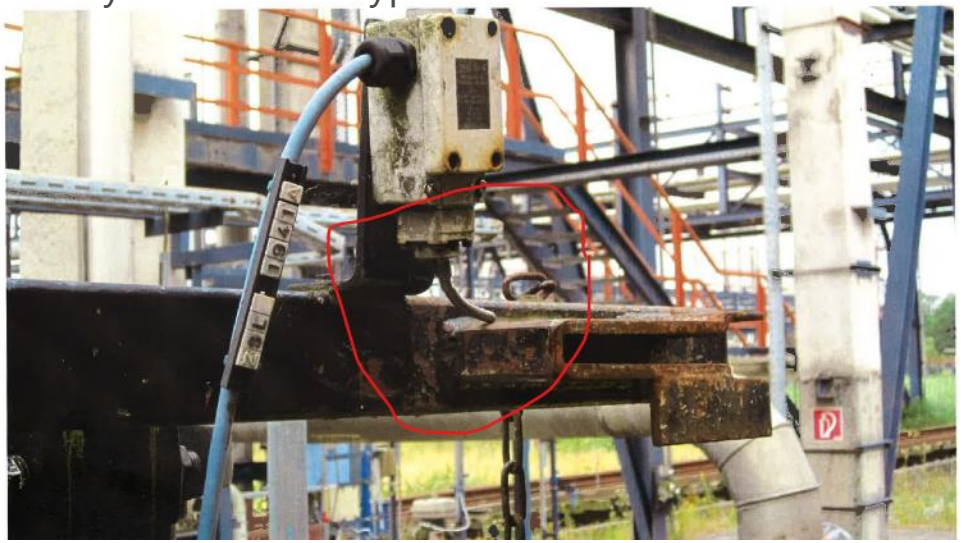
- **Direct Causes:**
  - Safety interlock System was intentionally bypassed
  - TU was not brought to the correct position to pass below the rail wagon

- **Indirect Causes:**
  - Breach of Work instruction:
    - Move of TU not allowed during loading!
  - Bypassing of safety interlock common practice in the logistics team!
  - Operators wanted to complete the job quickly
  - Construction of safety contact “easy to bypass”

- **Conclusions:**
  - Poor safety behaviour in the logistic team
  - Employees were transferred to logisitcs team which were seen as “low performers” (especially in SHE)!
  - Limited supervision and poor leadership by the direct supervisors!



Safety contact not bypassed -> TU cannot be moved



Safety contact bypassed -> TU can be moved

Example 1: Damage of railcar loading station

Learnings:

- Unauthorised Bypassing of any safety device is not acceptable!
- Bypassing of safety devices can lead to fatalities or major releases.
- Regular audits and check required if all employees are working according to the rules and operation instructions
- Well trained and educated operators and supervisors are required for logistics operations as well!
- Design safety systems in a way that they cannot easily bypassed
- Specific action for loading station:
  - Design of safety interlock system was adapted (see pictures of new interlock)

Example 2: VCM-Release during Railcar Loading

Loading Station and situation description

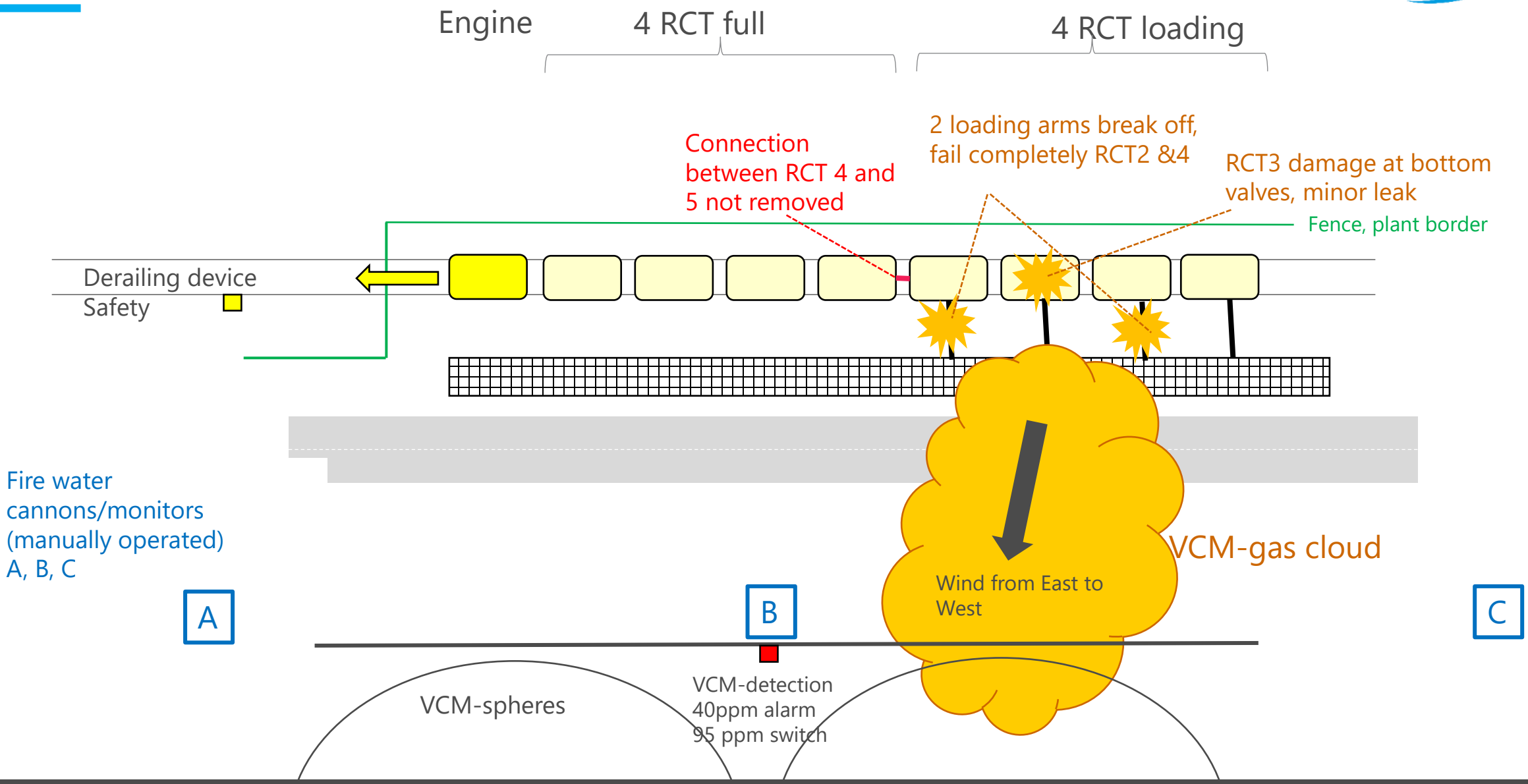
- VCM Loading asset with 8 loading stations -> daily loading of a VCM railcar train
- Engine (locomotive) enters loading area during loading of VCM-Railtank wagons
  - Only possible after bridging the derailing interlock in front of the loading area access gate

Example 2: VCM-Release during Railcar Loading

What happened:

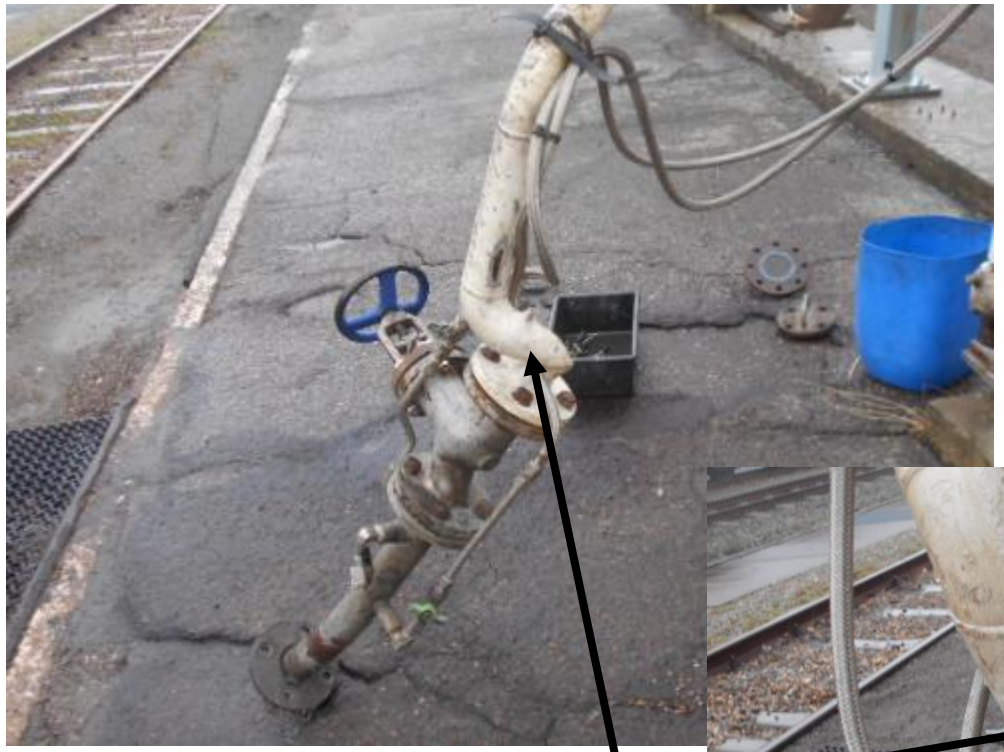
- 8 rail wagons in the loading station; Intention was to remove 4 already loaded wagons while the remaining 4 were loading
- Shunter attaches the engine to wagon 8, clears hand brake and wheel block and climbs back in Engine driver
- Shunter did not check the connection between wagon 4 and 5, assuming it was removed
  - Based on misunderstood communication via radio and handsignals with 2 loading area operators
- Engine started to pull the wagons but feel severe resistance. After about 3m they stopped to look for the cause.
- Due to the movement, 2 loading arms (wagons 2 and 4) break-off (gas and liquid arms), 2 other loading arms were severely damaged but not leaking
- A big gas cloud was formed and drifted to the VCM-storage and production area (12h33)
- Loading area operator who saw everything happening from the control room at the loading area was too shocked to press the emergency stop button

Location



Damage

Loading arm DN80 (liquid phase)



Loading arms gas and liquid phase severely damaged but not leaking

Example 2: VCM-Release during Railcar Loading

Why:

- Direct Cause:
  - Movement of the rail wagons by engine caused rupture of the loading arms
- Indirect Causes:
  - Conscious bypass of the derailing device by engine driver (team-leader) and shunter to access the loading area (Ex-zone) while loading 4 wagons.
    - Was done twice on the day of the incident, safety device was bypassed since early morning
    - The same way of working was used by other members of the loading team in previous days
  - Normal engine (locomotive) was in maintenance, therefore use of (light) spare engine.
    - Spare engine only able to pull 4 loaded wagons instead of 8
  - No check by engine driver and shunter whether the train was disconnected from the other 4 wagons.
  - Team wanted to be ahead of time and to facilitate the work of the upcoming shift!
  - Team-lead actively joined the unsafe way of working:
    - He did not stop his team-members
    - He was not addressing their unsafe behavior
    - He did not remove the bypass of the derailing device

Derailing device - safety

Magnetic contact

Bypassing simple by using metal plate, object

Engines

Heavy normal engine. In maintenance on the day of the incident. Able to pull 8 loaded RCT!

Light spare engine. Used during the incident. Only able to pull 4 loaded RCT instead of 8. Able to move 8 empty RCT at once

Example 2: VCM-Release during Railcar Loading

Learnings & Actions

- Technical Improvements
  - Installation of VCM-detection at loading area
  - Improving derailing device (making bypassing more difficult)
  - Installing additional emergency stop buttons at loading area
  - Improving rail hook system, also closing valves of loading arms and stopping loading pumps
  - Install fire water sprinkling on every loading point
- Review of all Safety Critical Bypasses in all areas and plants
- Start-up SHE-behavioral program for loading team – training, coaching, assessment
- Re-organization of the logistic team!
- Setting up bypassing procedure within logistics department

Final conclusions and learnings

- Do not accept any deviation of the standards and procedures (**"Normalization of Deviation")**
- Logistic operations like loading/unloading of railcars need the focus on Safety as process operations!
- Ensure that logistic teams have the same level of education and safety performance as the process operations teams
  - If this is not the case, dedicated programs on safety behaviour are required
  - "Leading by example" is required at all leadership levels!
  - Execute regular audits!
- A clear procedure on bypassing of safety critical devices is required
  - Clearly identify and label the safety critical devices
  - Ensure that all employees know which devices are safety critical
  - Define a Life Saving Rule and/or a Process Safety Fundamental for bypassing:
    - *Safety critical devices/interlocks must not be disabled or overridden without authorisation*

Questions?

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