INDUSTRIAL AND LOGISTIC ACCIDENTS - CASE STUDY

STUDY 9/A - NORMAL SYSTEM

1. Starting position and objective of intervention
In a road tanker accident, **a large amount of crude oil or refined oil products** is typically released from a damaged or overturned tanker. The incident often **occurs near a populated area**, on urban routes or busy logistics corridors, where pollution poses **an immediate human and environmental risk**.



The main factors aggravating the situation

- **High discharge volume:** up to *10 to 50 m³/tanker* → an extensive contaminated area quickly develops.
- **Inhabited area exposure:** inhalation, skin contact, evaporation, fire and explosion hazards.
- **The presence of urban drainage systems:** ditches, canals → rapid secondary migration (*spread of 0.2–0.5 m/h* in urban soil).
- **Sensitive environmental elements:** groundwater, green space, surface water bodies → long-term risk of PAHs and toxic fractions.
- **Traffic chaos and potential need for evacuation:** intervention and logistics are limited.

Intervention Objective (Normal System)
Aim of the intervention:

- Rapid localization **of pollution**,
- Limiting the spread of the
- Minimizing human and environmental damage,
- Safe **return of the area** (traffic restoration), in accordance with EU soil and water protection principles, as well as emergency and occupational safety protocols.

Reference case
2019 Ohio (USA) tanker accident: overturned tanker, approx. **30 m³ oil spill**, fire, soil and water system affected, **~5 million USD** total cost (evacuation + recultivation).

2. Nature of pollution (normal system)
Spilled oil is typically **hydrophobic, but** can partially emulsify **when precipitated**, which increases the spread and contamination zone.

Typical processes

- **Surface film formation** on asphalt → rapid expansion.
- **Infiltration into soil** (vertical + horizontal spread *0.1–0.5 m/h*).
- **Runoff/runoff migration** into channels and ditches → groundwater risk.
- **PAH and hydrocarbon load** → soil toxicity, reduction of biological activity.
- **Fire hazard + evaporation** → air pollution, toxic combustion products.

Long-term typical:

- Microorganism damage *20-40%,*
- Biodiversity loss *of ~30%.*

3. Traditional methods of intervention

3.1 Localization
Typical solutions:
- Sandbags, temporary barriers, barriers
- Trenching, earthworks

Limitations:
- They are not able to stop deeper infiltration → *50-70% efficiency*
- Installation is often delayed due to traffic situation
- Precipitation can break through the localization → *30-50% spread increase*

3.2 Surface removal
Typical solutions:
- Mechanical Absorption / Dredging
- Conventional absorbents: perlite, zeolite, vermiculite, PP-based materials

Limitations:
- Loss of efficiency due to water saturation (*30-50%*)
- Dredging in a populated area increases the dispersal of pollution
- Very high waste weight: *5-10×* weight ratio

3.3 Surface and structure treatment
Typical solutions:
- High pressure washing
- Bioremediation or surface repair

Limitations:
- Washing can spread the pollution
- Bioremediation is slow (*3-6 months*)
- Urban cost: *200-500 EUR/m²*

4. Operational challenges (normal system)
- A quick response is required, often in parallel with evacuation
- Official coordination: police, fire brigade, disaster management, HSE
- Logistics in a residential environment is difficult
- Total incident costs typically **€1-5 million**

5. Result (normal system)
- Localization typically **60-80%,** but chronic infiltration remains
- Significant post-cleaning (weeks to months)
- High waste and disposal costs
- Long-term ecological risks (*20-40% biodiversity loss*)

Summary - Status without exoline®
Conventional systems are reactive in **road tanker accidents** and operate in particularly limited areas because:
- The spread is rapid,
- Drains start migration,
- Absorbents are weakened in an aqueous environment,
- The amount of waste and the cost are extremely high.

STUDY 9/B - EXOLINE® OIL STOP

1. Starting position and intervention goal (with Exoline® system)

The baseline event is the same as described in Study 9/A. The **aim of** Exoline® Oil Stop **is not to replace traditional intervention steps**, but **to stabilize and improve them systemically**, especially in the case of critical weaknesses of traditional methods:
- Rapid spread on asphalt and towards drains
- Aqueous Mass Loss of Efficiency in Absorbents

- Secondary migration and chronic infiltration
- Human risk in built-up areas (evaporation, fire hazard)

Intervention goal with Exoline®

- Immediate immobilization **of oil** on asphalt and soil
- **Runoff and Groundwater Prevention**
- Reducing human risk **by creating** a non-mobile, non-dissipating state
- Faster space freeing → **traffic recovery**
- A treatment that **does not disperse or increase the toxicity of the water column**

2. Pollution behavior with Exoline® (behavior change)

2.1 Surface oil film

- **Exoline®** forms a selective bond with the oil phase
- Oil **can be brought to** a paste-like/low-mobility state
- The rate of spread can be significantly reduced, and it becomes more manageable in case of precipitation

2.2 Soil infiltration

- Fast adsorption stabilization reduces deep infiltration
- Reduced risk of remobilization → less chronic load

2.3 Secondary migration (sewer / ditch / groundwater)

- Retention of PAH and aromatic fractions in place is improved
- It does not create a dispersed secondary pollution phase
- Supports controlled aftercare options (bioremediation, soil replacement)

3. Improved intervention methods with Exoline® system

3.1 Localization + Stabilization

- **Exoline® application in critical zones:**
  - In the vicinity of the tanker
  - In sloping runoff directions
  - At sewer openings and catchment points
- Can be integrated with barriers and barriers
- Can be used independently or combined with a mineral substrate

Result:

- The "spread window" is shorter
- Mobile oil phase can be controlled faster
- A more stable workspace is created

3.2 Surface removal and disposal

- The bound oil is less saturated with water
- Mechanically easy to handle: collecting, dredging, pumping
- Reduced risk of smudging and back-leakage

Result:

- Waste can be reduced **in the range of** 30-50%
- Logistics and hazardous waste management costs are reduced
- Faster site clearance

3.3 Surface and structure treatment

- Pre-wash **Exoline®** stabilization reduces the risk of spreading
- Fewer water operations required
- More targeted bioremediation or soil replacement in the case of post-treatment

4. Operational impact (with Exoline® system)

- Fast stabilization → more time for decision-making and secure organization
- Lower fire risk by reducing the mobile oil phase
- Simplified logistics (less waste, less repetition)
- Total cost of ownership can be reduced, especially for waste and recultivation components

5. Result - with Exoline® Oil Stop System

- Localization in critical zones **>80%**
- Reduced post-cleaning and recultivation
- Incident costs **can be reduced by 30-40%** depending on the location
- Mitigated long-term ecological risk

Target of biodiversity loss **of <20%** with appropriate protocol

Final Note - Lessons from a Road Application

Exoline® Oil Stop is a stabilization and risk mitigation tool **in the event of road tanker accidents**, which:

- It buys time for the interveners,
- It reduces human risk in populated areas,
- Helps you recover traffic faster,
- And it creates a controlled state in which the effectiveness of traditional methods can be significantly improved.