

“Capacity Building and Strengthening Institutional Arrangement”

Workshop: Quantitative risk assessment of oil and gas plants“

Working Group n°. 4

**“Consequences Assessment Analysis of Major
Hazard Oil and Gas Spill in Soil and
Groundwater”**

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Objective

By applying the methodological approach aimed to evaluation of environmental consequences define Propagation Tendency Indexes (PTIVR and PTIGW) for a selected oil depot with the aim to determine if the comparison between evaluated safety distances and real distance from each plant unit might generate a critical scenario for ground water and its connected vulnerable receptors. In case of critical scenario occurrence suggest a feasible protection countermeasure to be adopted in order to reduce risk of contamination.

Activities

1st phase: Selection of an industrial plant (among existing ones) where an accidental oil release could interest ground water and neighboring vulnerable receptors. Provide yourself with a map in adequate scale reporting source of contamination (plant units) and all those potential vulnerable receptors close to establishment the might be impacted by contamination.

2nd phase: Identify those logical units where an accidental oil release may occur (tanks basin) and associate to each one an hypothetical probability of eco-toxic release value to be compared with Release Tendency Index Classification (Very Low, Low, Medium, High)

Activities

3rd phase: In this phase the determination of parameters to be used to PTI evaluation will be executed.

Check for possible data source necessary to determine:

- Distance from Vulnerable receptors in meters.
- Average Aquifer Hydraulic Conductivity **K**
- Average Groundwater Hydraulic Gradient **i**
- Average Groundwater Flow direction
- Aquifer Effective porosity η
- Depth to water table in meters
- Aquifer thickness
- Index value related to land-use class associated to each Parcel adjacent to industrial establishment
- Index Value related to aquifer remediation attitude (Aquifer Typology)
- Index Value related to aquifer exploitation potential. Evaluate it by taking on account Hydraulic Conductivity **K** and aquifer thickness using the following table

Activities

| | Hydraulic conductivity Meters/sec | | |
|-------------------------------|--------------------------------------|-------------------|-------------|
| Aquifer thickness (meters) | $<10^{-6}$ | $10^{-6}/10^{-3}$ | $> 10^{-3}$ |
| ≤ 5 | 0 | 0 | 1 |
| 5-10 | 0 | 1 | 2 |
| >10 | 1 | 2 | 2 |

Activities

4th phase: By using Darcy Law $V = Ki/\eta$

Evaluate:

- Vertical time arrival
- Horizontal seepage velocity
- Propagation Tendency Index for Vulnerable Receptors (PTIVR)
- Propagation Tendency Index for groundwater (PTIGW)

Compare RTI values (estimated in 2nd phase) and the evaluated PTIVR and PTIGW on the two related critical matrices in order to identify safety distance for each category of vulnerable receptor defined in 3rd phase as well as the existence of critical scenario for groundwater.

5th phase: If critical scenarios subsist indicate an adequate protection countermeasure to reduce ground water velocity and mitigate environmental consequences.