EVALUATING ENVIRONMENTAL IMPACTS OF FLOOD-INDUCED TANK FAILURES: A RISK CHAIN MODEL FOR SOIL AND GROUNDWATER CONTAMINATION IN NATECH CONTEXT

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CONTEXT

- Natural Event triggering Technological disaster
- Flood Directive 60/2007/EC[A]
- Seveso III Directive 2012/18/EU[B]
- Multi-component Flood Risk Assessment

OBJECTIVES

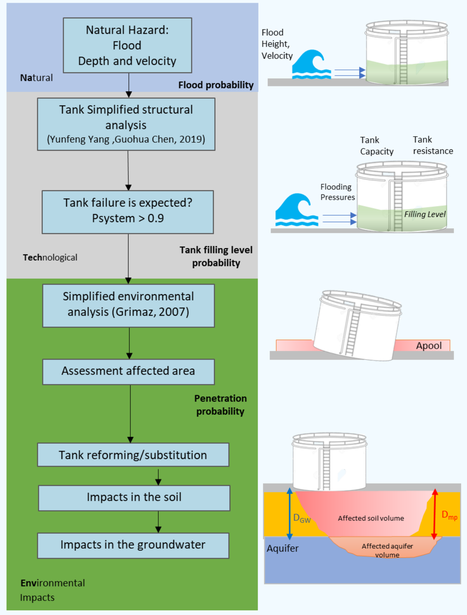
- New NaTechEnv risk chain[C]
- Vulnerability assessment
- Consequence analysis[D]
- Environmental damage on soil and groundwater

METHODS

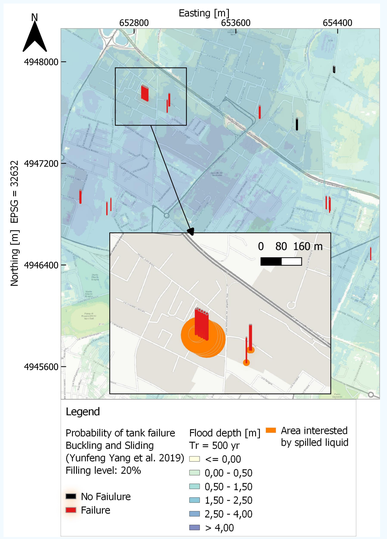
- Retrieving tank data from GIS regional database
- Tank vulnerability assessment through Logistic regression, Buckling and rigid sliding failure dynamic
- Environmental consequences analysis: impacts on soil and groundwater
- Case study: Secchia River Basin – Northern Italy

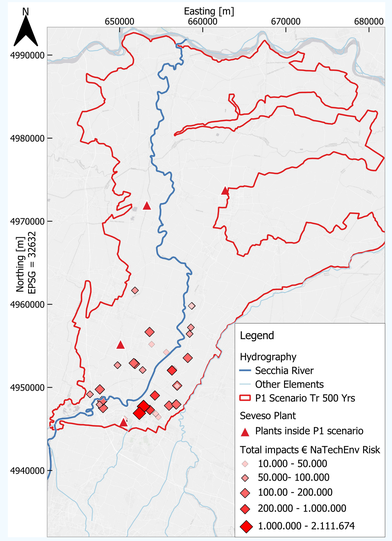
KEY POINTS ON METHODOLOGY

- Fast methods applicable over large area, like APFSR areas identify by Flood Directive
- Many parameters are required, simplification can be made through assumptions and scenarios
- Scenarios probabilities depending on different types of variables, such as probabilities related on flood, operational parameters (filling level), type of substances spilled.



ILLUSTRATIVE CASE STUDY: APFSR SECCHIA





%failure tanks / Total damage [M€]		Tank filling level 20%	40%	60%
Flood recurrence scenario [Yr]	200	29.2% - 17.99	8.3% - 3.00	0.8% - 0.26
	500	33.8% - 26.64	10.0% - 3.75	2.9% - 0.84

- Risk assessment conducted using data from a fluvial hazard scenario with a recurrence time (Tr) of 500 and 200 years.
- The proposed risk chain has been executed based on a set of assumptions.
- Tank data has been retrieved using a GIS database, and the height of the tank has been assumed to be equal to its diameter.

CONCLUSION

- A novel methodology has been introduced for the evaluation of flood risk associated with the release of pollutants from tanks at catchment scale.
- The method is scalable, providing the capability to assess risk from a single tank up to the entire flood-prone area.
- The proposed methodology was applied to the Secchia APSFR in northern Italy to evaluate "NaTechEnv" damages from potential pollutant releases from 240 tanks located in various industrial sectors.
- NaTech events can be caused by industrial sources that are not classified as Seveso industries. Therefore, it is important to consider the potential for NaTech events in all industrial sectors, regardless of their regulatory classification.
- Assuming a filling level of 20%, the results indicate that 33.9% of total tanks are at risk of collapsing during a 500-year scenario.
- In case of a 60% filling level, the percentage of collapsed tanks decreases to 2.9%.
- The comparison between "NaTechEnv" damages and other assessed monetary damages demonstrates that this kind of risk has the same order of magnitude as agricultural damages

REFERENCE

- **A:** Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks
- **B:** Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC. (2012)
- **C:** Yang, Y., Chen, G., & Reniers, G. (2020). Vulnerability assessment of atmospheric storage tanks to floods based on logistic regression. Reliability Engineering & System Safety, 196, 106721. https://doi.org/10.1016/j.ress.2019.106721
- **D**: Grimaz, S., Allen, S., Stewart, J. R., & Dolcetti, G. (2008). Fast prediction of the evolution of oil penetration into the soil immediately after an accidental spillage for rapid-response purposes. 3rd International Conference on Safety & Environment in Process Industry. http://www.aidic.it/CISAP3/

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YOUR FEEDBACKS ARE WELCOME

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