

# *Sustainable water management in Italian oil refineries related to climate change*

**Integrated solutions to adapt water systems to  
climate change: European and Mediterranean  
impacts, solutions and innovation actions**

**Genève Farabegoli, Federico Blesi, Maria Cortese, Paola  
Giorgioli, Chiara Giuliani, Simona Spuri (ISPRA)**

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# Who we are

## **ISPRA – Italian Institute for Environmental Protection and Research**

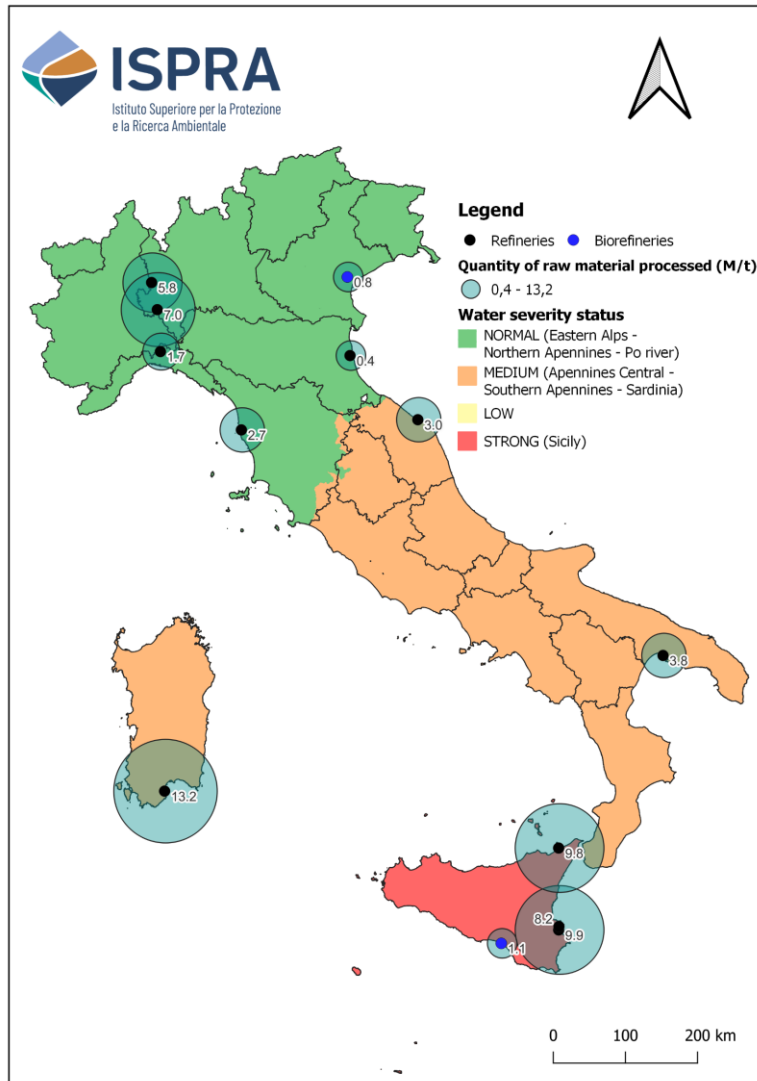
It is the national control authority for environmental inspections, monitoring and assessments of IED installations under state jurisdiction (Annex XII D.Lgs n. 152/06).

## **Department of Environmental Assessment, Control and Sustainability**

### **Unit on "Control of installations in the hydrocarbon sector"**

Carries out technical-scientific and inspection activities related to industrial cycles in the hydrocarbon refining sector, aimed at the prevention and control of environmental impacts, pollutant removal techniques and water reuse after purification.

# Refineries in Italy



The refinery sector in Italy plays a crucial role in the country's energy industry

13 active refineries, under IED

2 recently converted into biorefineries as part of the country's push toward more sustainable energy production.

Oil refineries are water consumers, this demand can place intense pressure on local water resources, which is especially concerning in areas already prone to drought or experiencing water scarcity.

*Image source: ISPRA elaboration of the water severity status (updated 27/10/2024) with location of the 13 Italian refineries and quantity of raw material processed referring to 2023.*

[https://www.isprambiente.gov.it/pre\\_meteo/idro/SeverIdrica.html](https://www.isprambiente.gov.it/pre_meteo/idro/SeverIdrica.html)

# Water consumption in refineries (2023)



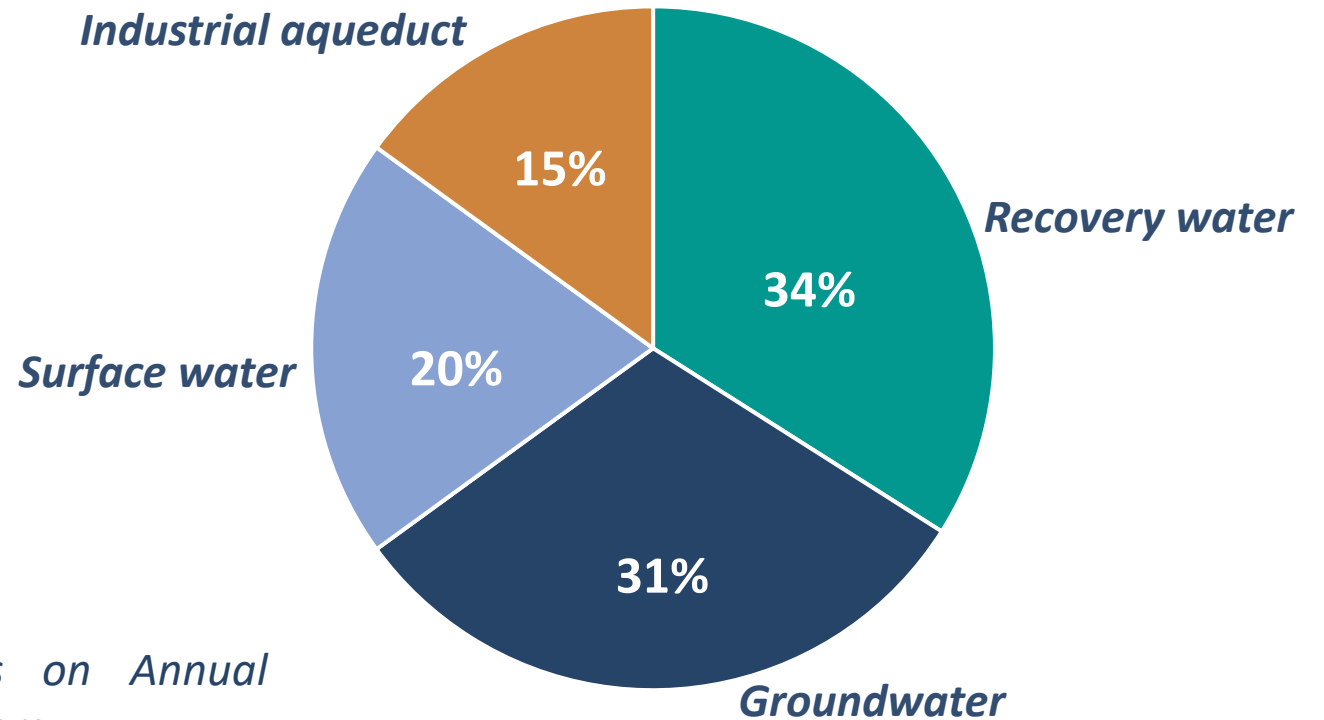
The average amount of water consumed by the thirteen installations was approximately **46 million m<sup>3</sup>**.



Just under **6 million m<sup>3</sup>** net of sea water, used mainly for cooling and then returned to the source.

*Data source: ISPRA elaborations on Annual Reports provided by refinery operators.*

Percentage breakdown of the water supply of all refineries/biorefineries.



# The impact of climate change

Climate change significantly impacts water availability for industries like oil refining, not only through prolonged droughts but also by increasing the frequency and severity of extreme weather events. Floods, sea level rise, and intense storms can pose multiple risks to refineries and their surrounding environments.



The flooding at the ENI refinery in Livorno (09/09/2017) that caused the release of hydrocarbons that contaminated the surrounding waterways.

<https://www.snpambiente.it/snpa/arpa-toscana/la-situazione-ambientale-a-livorno-dopo-lalluvione/>

# GIS (Geographic Information Systems) spatial analysis

It is a powerful tool for assessing risks related to infrastructure and environmental impact.

By integrating geospatial data layers, GIS allows to map and analyze various risk factors that could influence the safety and resilience of installations like oil refineries.

GIS can contribute to each of these specific analyses:

- **Distance to Water Bodies and Coastline**
- **Tsunami Warning Areas**
- **Hydraulic, Seismic, and Landslide Risk Areas**
- **Proximity to Protected Areas**
- **Surface Area and Population Potentially Affected**

# Real case studies



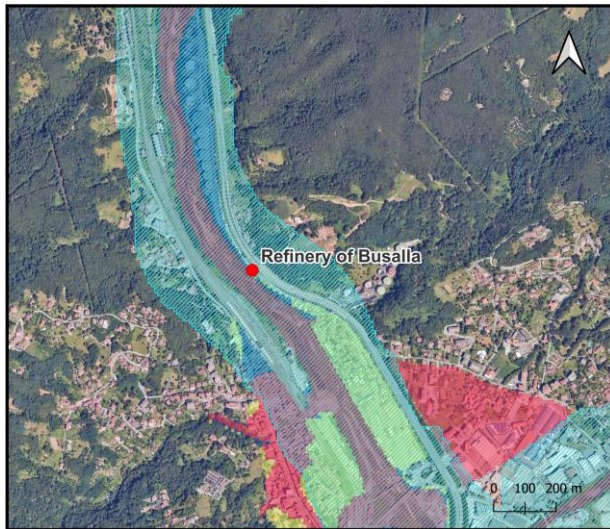
Most of the refineries are located in areas subject to climate water-related risks:

- ✓ 4 are included in hydraulic hazard maps (high-risk class)
- ✓ 10 are located within 150 meters of a surface water body
- ✓ 4 border protected areas
- ✓ 4 are within the high seismic hazard class
- ✓ 10 are potentially exposed to tsunamis hazard

Real case studies potentially at risk due to the characteristics of the area in which they are located or where a recent extreme weather event has occurred

# Measures implemented

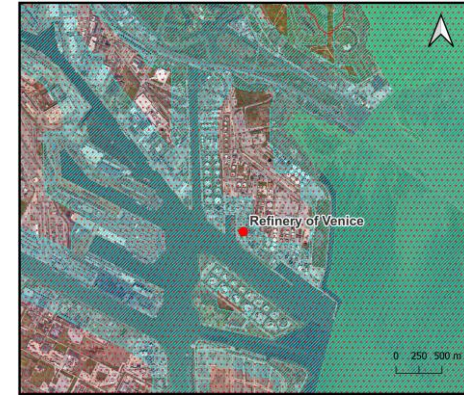
**Refinery of Busalla:**  
works mainly involving the raising of the entire existing bank wall.



Hydraulic hazard area  
 low class  
 middle class  
 high class  
 Buffer area water bodies (150 m)

## Refinery of Venice:

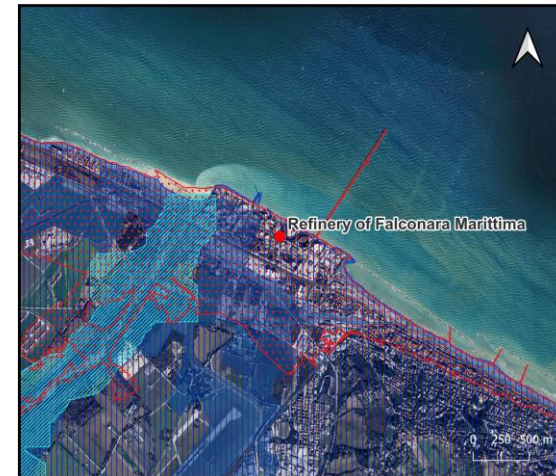
embankment and containment works on the lagoon shores



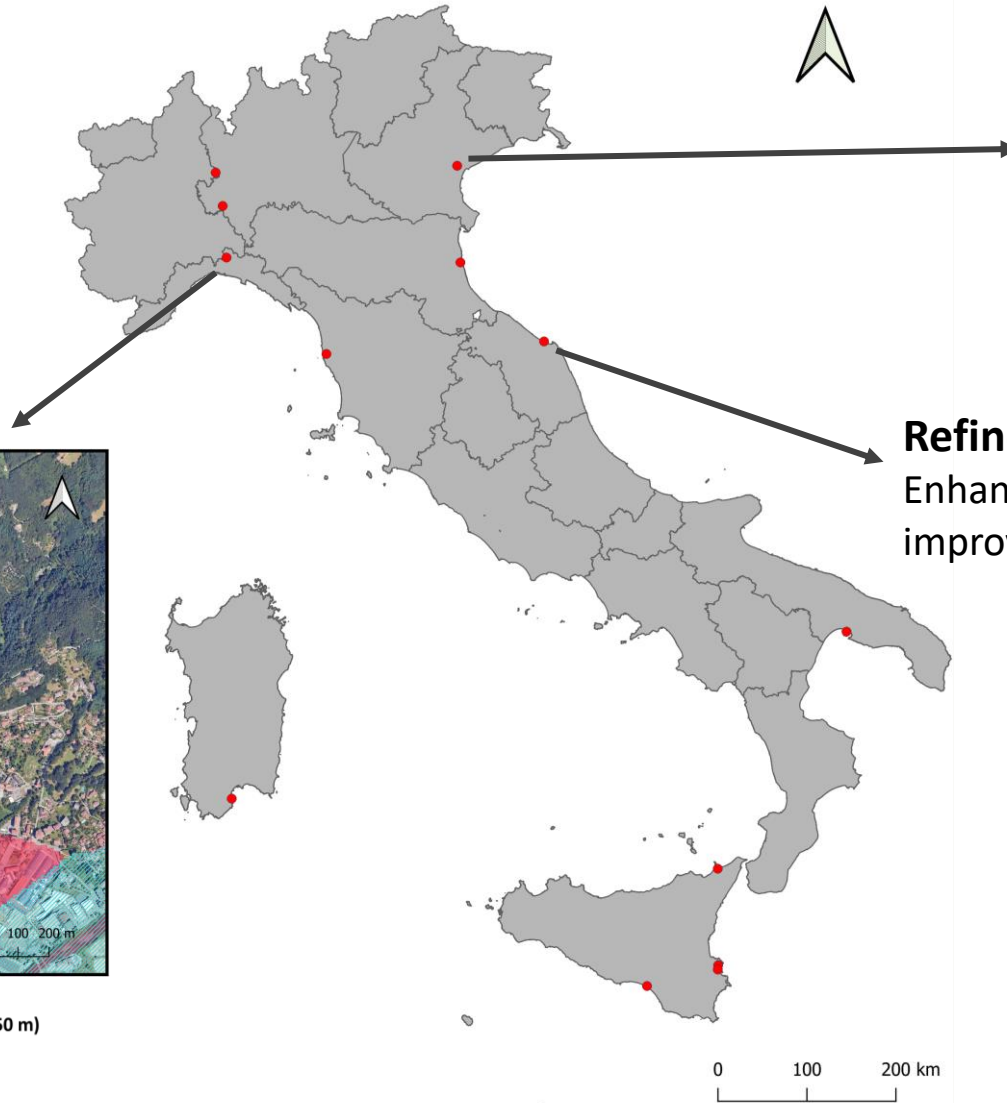
Tsunami warning area  
 Buffer area water bodies (150 m)  
 Natura 2000 Network

## Refinery of Falconara Marittima:

Enhancement of the emergency response plan (including improved drainage systems and protective infrastructure)



Hydraulic hazard area  
 middle class  
 high class  
 Seismic hazard  
 high class  
 Tsunami warning area

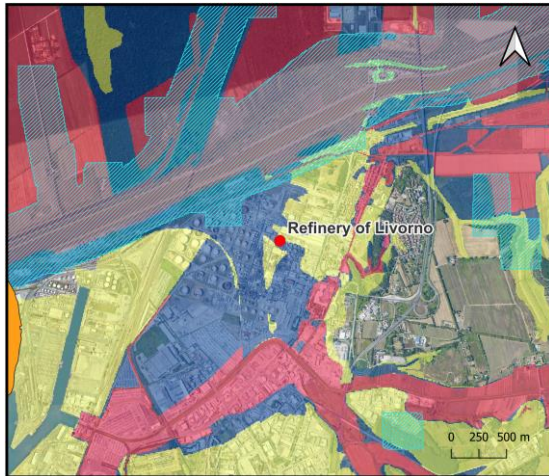




# Measures implemented

## Refinery of Livorno:

Prevention and protection measures (new paved areas equipped with a suitable rainwater collection and sewage system)

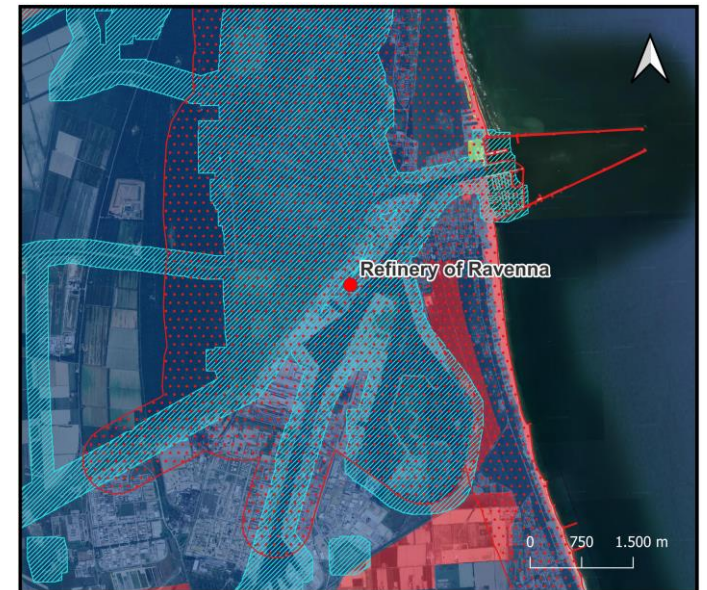


Hydraulic hazard area  
 low class  
 middle class  
 high class  
 Buffer area water bodies (150 m)



## Refinery of Ravenna:

Improvement of the Integrated Management System with operational instruction related to the risk of flooding



Hydraulic hazard area  
 low class  
 middle class  
 high class  
 Seismic hazard  
 high class  
 Buffer area water bodies (150 m)  
 Tsunami warning area

# Other actions taken by refineries against climate change

- **Reducing water consumption:** optimising processes to reduce the need for water from local water resources (surface and groundwater).
- **Water recycling and reuse:** increasing reuse within the production cycle, promoting reuse of recovered and treated water also outside the refinery.
- **Advanced treatment plants:** removing contaminants and reducing the risk of contamination of local water resources.
- **Spill prevention:** maintenance and monitoring of storage tanks and transport lines to reduce the risk of contamination.
- **Containment zone:** to counteract any spills before they reach natural water bodies.
- **Water risk management:** Water management plans that take into account the effects of climate change, such as water scarcity and flooding.

# Conclusions

The case studies showed how industrial infrastructure can operate in areas subject to hydraulic risk **only if effective measures to manage and mitigate the risks** associated with floods and extraordinary rainfall events are adopted.

These examples also provide the opportunity to reflect on:

- best practices against the influence of ongoing climate change
- the effectiveness of current European and National environmental regulations
- regulatory bodies should enforce stricter environmental and safety standards, forcing to invest in adaptation measures



ISPRA archive confidential images

**Thank you for your attention**