

“Capacity Building and Strengthening Institutional Arrangement”

Workshop: Quantitative risk assessment of oil and gas plants“

Main environmental issues of drilling technologies

Mr. Gaetano Battistella, Mr. Alfredo Leonardi, Mr. Fabrizio Ciocca

APAT

Agency for Environmental Protection and Technical Services

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1 Introduction

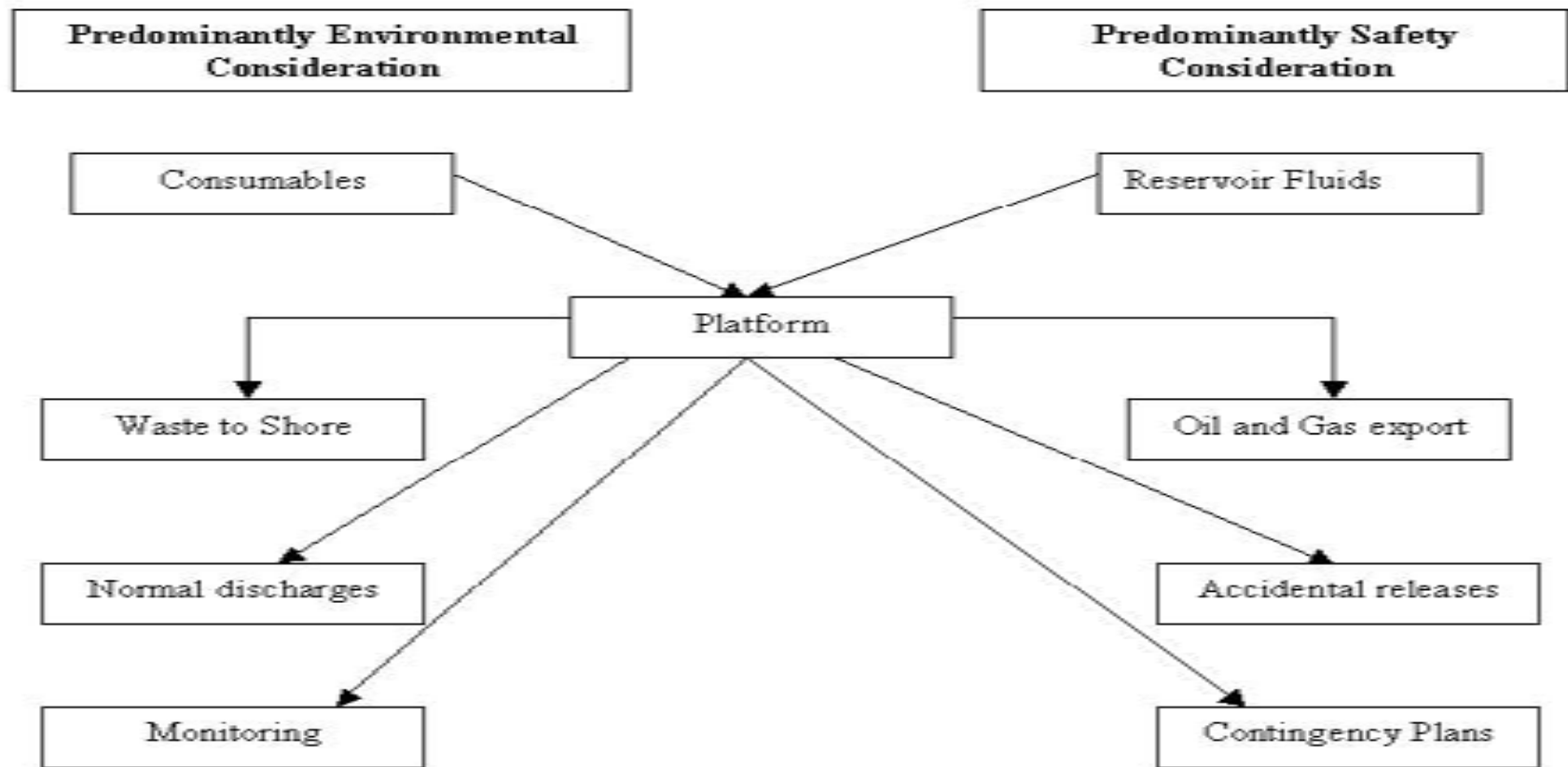
2. Impacts on Environmental matrixes

1.Introduction

In order to study and to control environmental impacts such as air emission, waste water discharges, water (consumption and discharges), noise and contamination of the land and sea, it's important that every productions sites and refineries can have an accurate analysis with the objective to define any specific environmental aspects that are related and affected by the oil and gas plants

1. Introduction

Typical flow chart for platforms environmental and safety impacts



2. Impacts on Environmental matrixes

The drilling and refineries activities, off-shore and platform production have different impacts on a series of environmental matrixes, such as:

Air (pollutants emissions and noise)

Water (consumption and waste water discharges, sea pollution)

Waste

Energy (consumption)

Nature and biodiversity (flora and fauna)

Demography and economy (socio-economic and traffic issues)

2. Impacts on Environmental matrixes

Air: pollutants emissions

The pollutants involved are typical of refining and distribution activities and the atmospheric emissions are estimated on the basis of the properties of the fuels used. Usually the main pollutants that are checked are CO₂, CO, NO_x, SO₂ and Dusts, expressed in relation to the production of electric energy

Emissions

	2000			2001		
	t	kg/kWh electric (1)	kg/kWh exergetic (2)	t	kg/kWh electric (1)	kg/kWh exergetic (2)
CO ₂	4,378,672	0.81	n.d.	4,235,955	0.80	0.57
CO	835	0.15	n.d.	746	0.14	0.10
NO _x	6,510	1.20	n.d.	6,886	1.30	0.92
SO ₂	18,809	3.47	n.d.	21,700	4.09	2.91
Dusts	640	0.12	n.d.	647	0.12	0.09

(1) Index of consumption calculated in relation to the gross electric energy produced.

(2) Index of consumption calculated in relation to exergy, that is, to the sum of gross electric energy produced and energy associated to the steam produced and expressed in MWh.

Example of emissions for a oil refineries (Eni source)

2. Impacts on Environmental matrixes

Air: Noise pollution

When gas plant or refineries are close to urban areas, it is important to measure the impact of acoustic pollution, included noise levels from fixed and mobile noise sources.

The main sources of noise in the gas transmission system are the compressor stations, which are usually in rural areas along the primary pipeline network and the pressure reduction stations.

2. Impacts on Environmental matrixes

Water: consumption and waste water discharges

Water is an important element part to consider in evaluating the consumption of natural resources.

Most of the water consists of sea-water for cooling thermal power plants at the refineries. The total offtake of water for cooling purposes depends on the quantity of crude throughput but is also influenced by the average annual temperature.

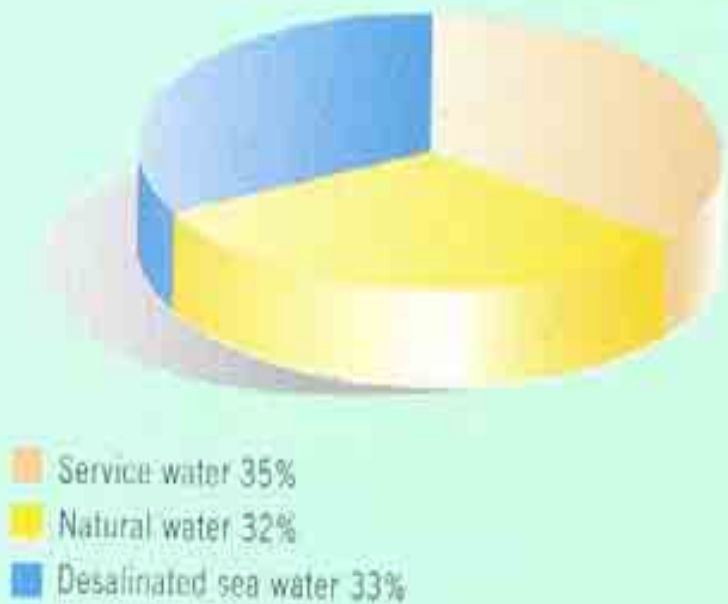
Different types of water are used to meet the needs of production activities: natural water (taken from surface water bodies or from groundwater), service water and sea water, which maybe desalted

In addition it's also used seawater without be desalted, for ballasting and cooling motors of offshore vessels

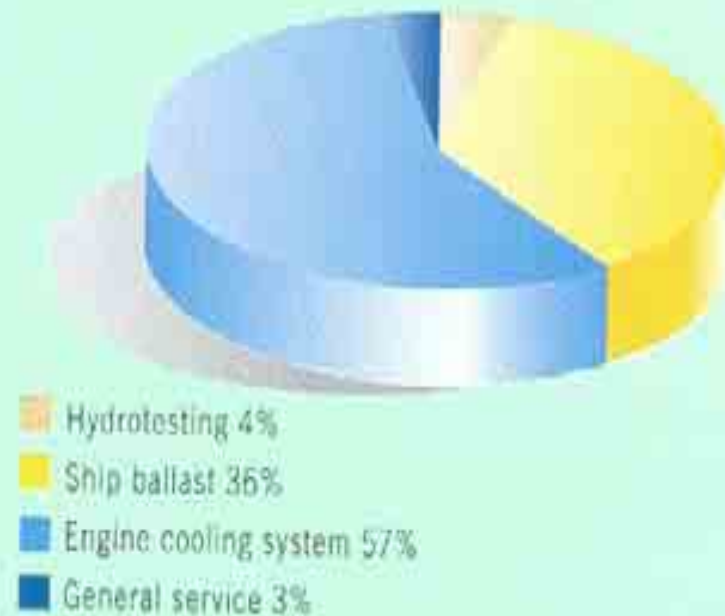
2. Impacts on Environmental matrixes

Water: consumption and waste water discharges

Types of consumed water - 2001



Structure of water consumption
 Type of use of water - 2001



Example of water consumption for a oil company (Eni source)

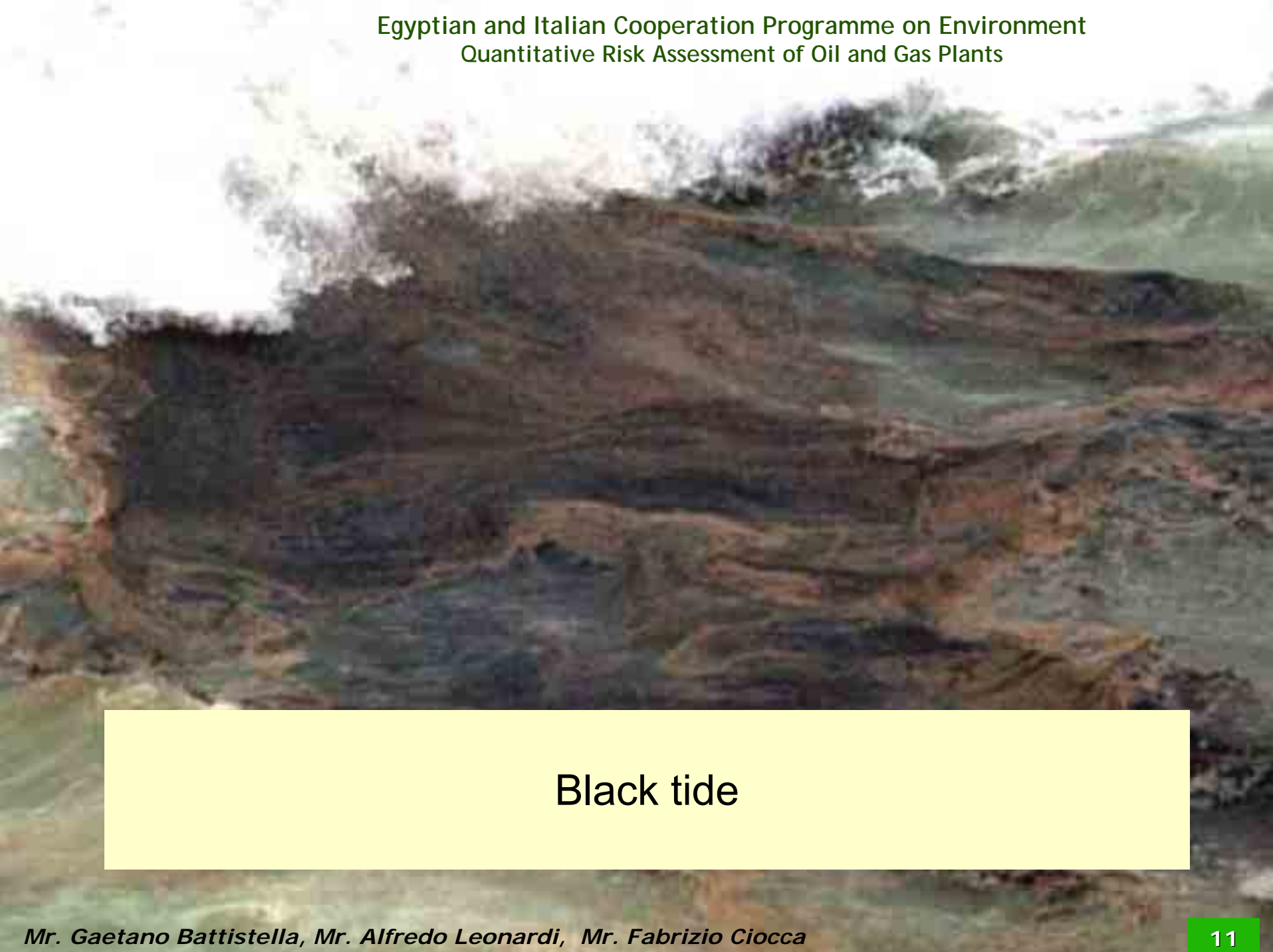
2. Impacts on Environmental matrixes

Water: consumption and waste water discharges

The main pollutants measured in waste water discharges are the COD (chemical oxygen demand), BOD (biochemical oxygen demand) and TSS (total suspended solids)



Example of waste water discharges for a oil company (Eni source)



Black tide

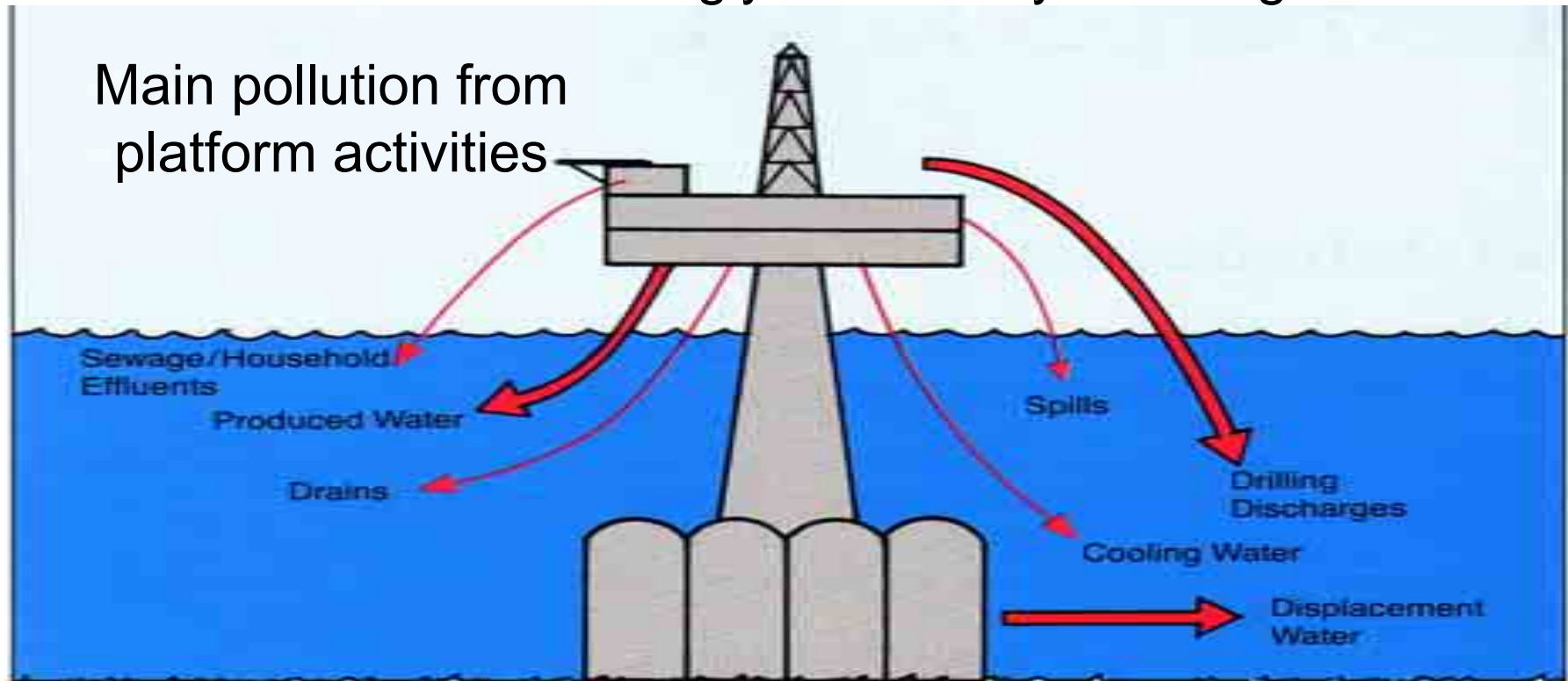


Damages to the coast

2. Impacts on Environmental matrixes

Water: Sea pollution

Sea pollution produced by off-shore oil and gas activities became relevant public concern during last years and marine and coastal environment have been strongly affected by discharges on sea



2. Impacts on Environmental matrixes

Water: Sea pollution

Main concerns of platform pollution is “Produced Water”

Formation water occurs together with oil and gas in the reservoirs. A mixture of oil, gas and water flows to the production facility and the water, called ‘produced water’ is separated and treated for oil removal being discharged into the sea. On some installation sea water is injected into the reservoir for pressure maintenance. Generally, produced water contains varying concentrations of natural compounds :

- Dispersed oil and dissolved oil (aliphatic hydrocarbons, aromatic hydrocarbons, phenols, carboxylic acids, metals, etc.)
- Minerals from the formation

2. Impacts on Environmental matrixes

Water: Sea pollution

Main limits for platform discharges

- | | | |
|------------------|-----------------|------------------|
| • Produced water | max oil content | 40 mg/l (Paris) |
| • Drainages | max oil content | 100 ppm (MARPOL) |
| • Drill cuttings | max oil content | 100 g/kg (Paris) |

2. Impacts on Environmental matrixes

Water: Sea pollution

Ballast Water is used to stabilize vessel and its sediment can act as a vehicle for the transfer of marine species, disease and contaminant, polluting the marine environment



Zooplankton from Ballast Water



Ballast Water Release

2. Impacts on Environmental matrixes

Water: Sea pollution

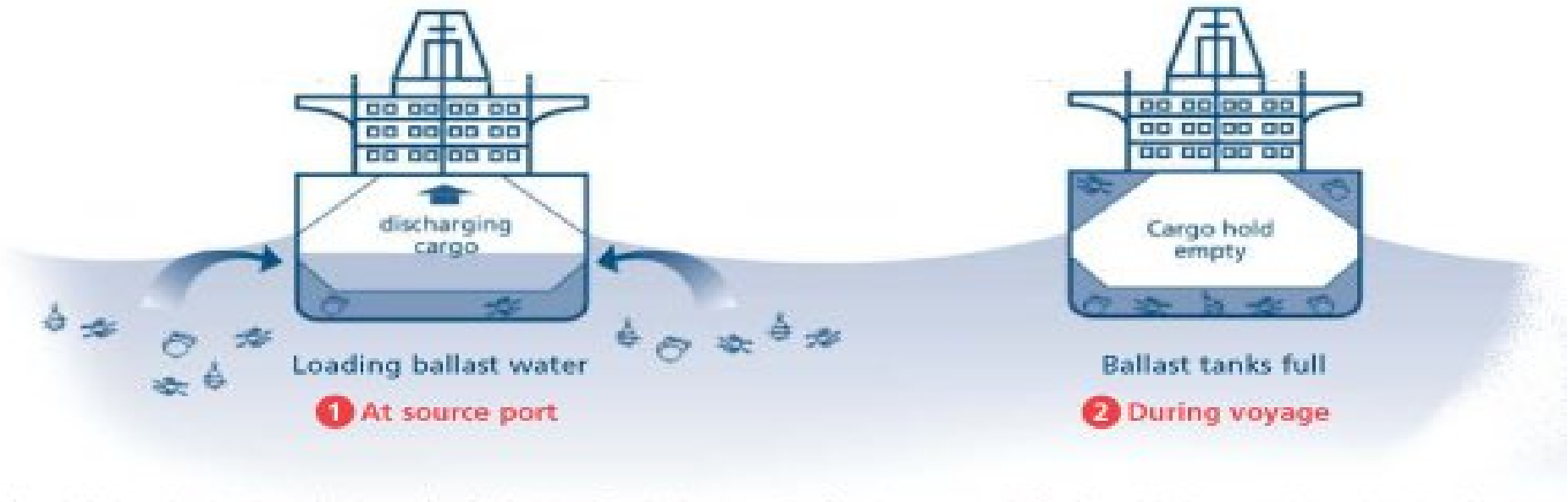
Water Ballast are used since the 1880' to improve stability, draft and maneuverability and to prevent stressing and structural damage which can be caused by uneven loading or rough seas. It is estimated that about 10 billion tonnes of water is transported globally per year

Operational issues

- Ballast water is loaded on vessel after oil discharge on port facilities and before the left
- Ballast water is unloaded on appropriate port facilities
- Stored in a number of ballast vessel (generally steel)
- Volume of ballast and configuration varies from vessel to vessel

2. Impacts on Environmental matrixes

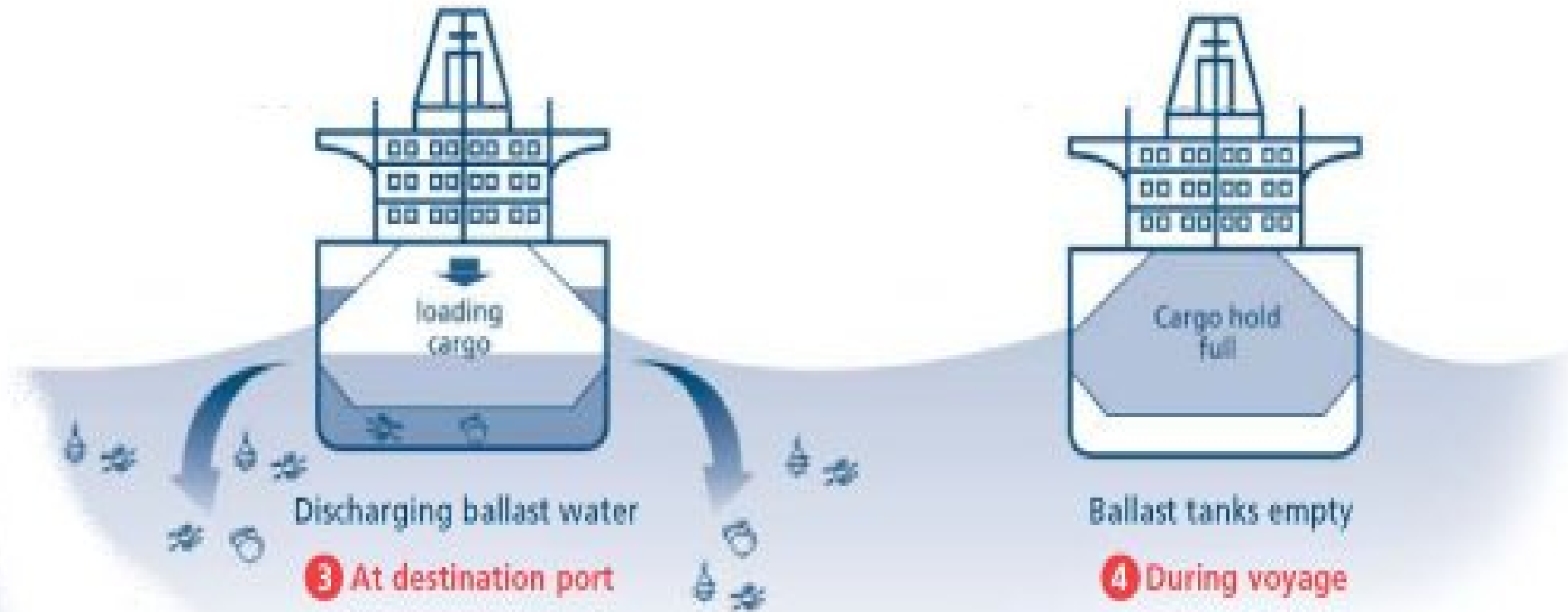
Water: Sea pollution



Loading Ballast

2. Impacts on Environmental matrixes

Water: Sea pollution



Unloading Ballast

2. Impacts on Environmental matrixes

Water: Sea pollution

Environmental consequences of Ballast water is that can be introduced non-indigenous and non-native species in a new environment, with the following consequences:

Dangerous effects:

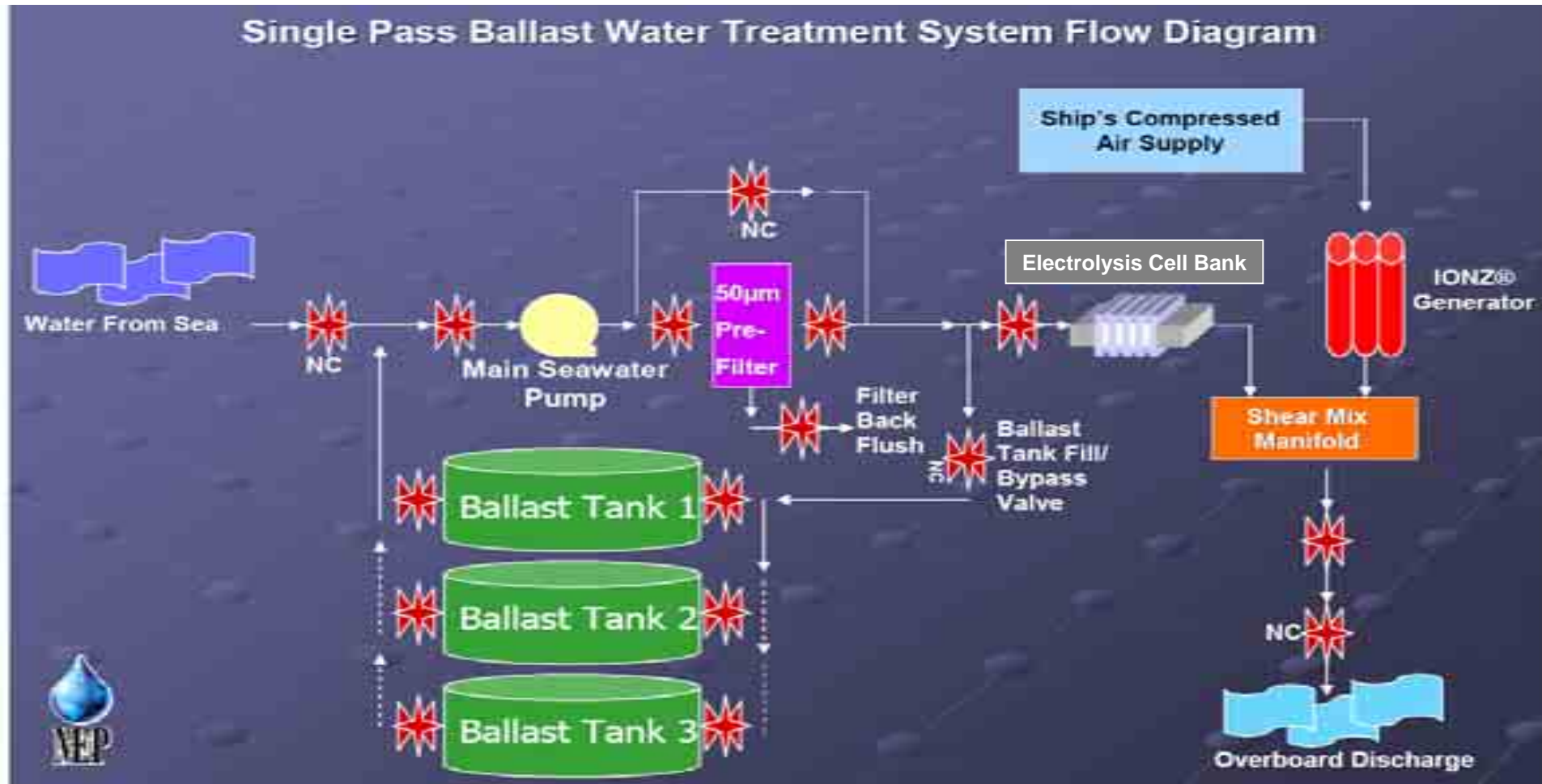
- competing with native species for food or space
- alteration to existing ecosystem, e.g. water quality, predators
- gene pool alteration
- displacement of native species
- introduction of disease or parasite
- toxic species leading to economic losses

2. Impacts on Environmental matrixes

Water: Sea pollution

Example of ballast water treatment system

Single Pass Ballast Water Treatment System Flow Diagram



2. Impacts on Environmental matrixes

Waste

Most of the annual waste production is produced by the following activities:

- Plant decommissioning at company sites and the relevant clean-up/remediation activities
- Disposal of spent catalysts cyclically produced by conversion plants in refining process
- Disposal of residues from industrial water production processes and industrial waste water treatment plants
- Shut-downs of refining plants for maintenance and the relevant clean-ups

2. Impacts on Environmental matrixes

Waste

Some of these activities are of a cyclical nature, such as those connected with operations that have taken place prior to the current year, such as example excavation and demolition or remediation operations

Waste	2000		2001	
	t	%	t	%
	Non-hazardous waste	5,583	97	4,180
Recovered non-hazardous waste	5,072	91 (1)	2,862	68 (1)
Hazardous waste	163	3	123	3
Recovered hazardous waste	141	87 (2)	39	32 (2)
Recovered/recycled waste	5,212	91	2,901	67
Total	5,746		4,303	

(1) Percentage refers to total non-hazardous waste produced.

(2) Percentage refers to total of hazardous waste produced.

Example of waste production for Oil company (Eni source)

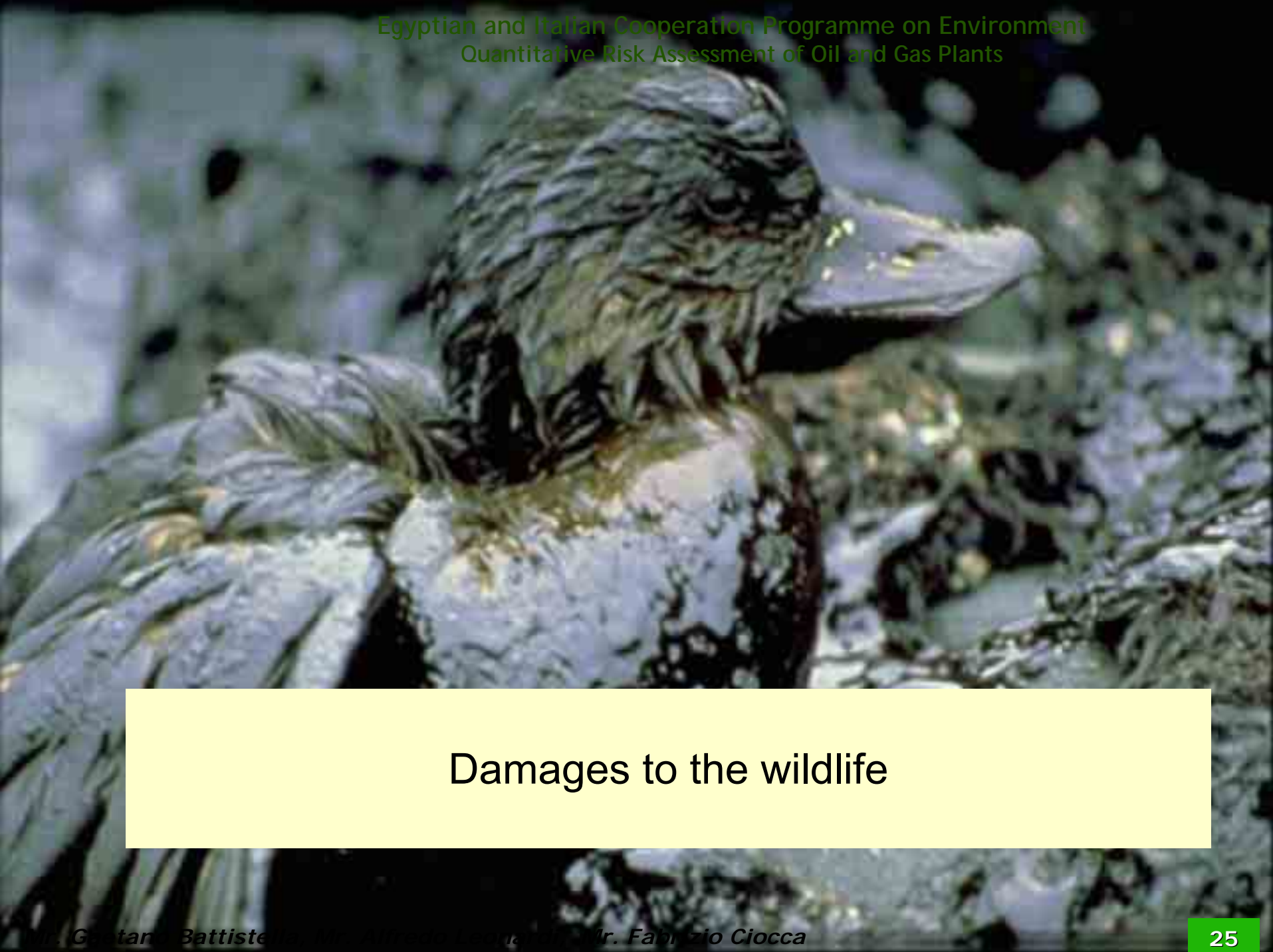
2. Impacts on Environmental matrixes

Nature and biodiversity

The fauna and flora can have a strong impact from activities such as drilling or production actives. In this case should be analysed and collected data about the environmental impacts on terrestrial and aquatic habitats, biodiversity, ecological communities, populations and species protected



Oil pollution on the rocks

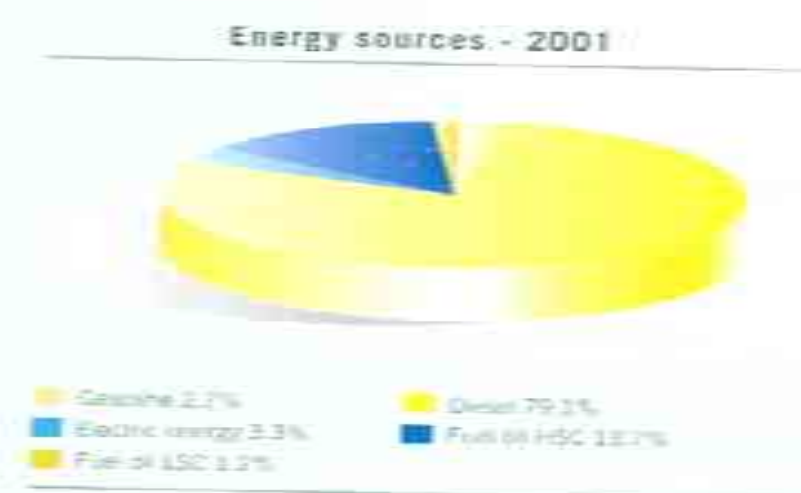
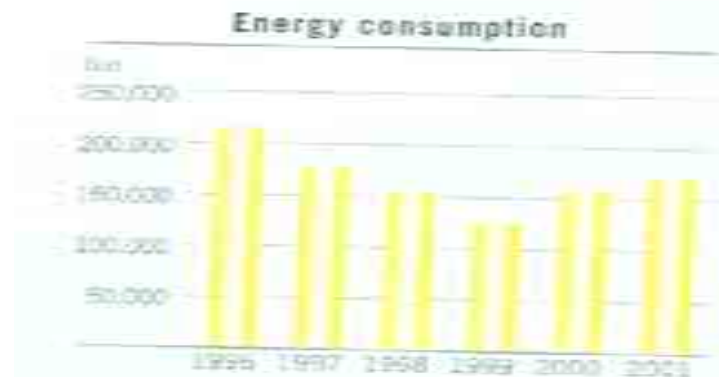


Damages to the wildlife

2. Impacts on Environmental matrixes

Energy: consumption

Energy consumption is essential for evaluating the extent of production activities and the use of natural resource. Usually energy consumption comprises electricity supplied by the national grid and fuels used to generate electrical, mechanical and thermal energy. Diesel oil is mainly used to fuel generators at drilling sites and for powering vehicles and equipment (vehicles, lorries, sidebooms, etc.)



Example of energy consumption

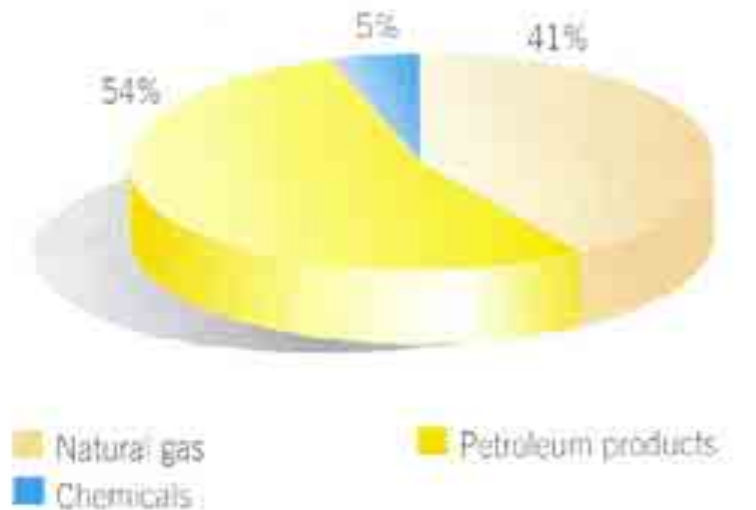
for Oil company (Eni source)

2. Impacts on Environmental matrixes

Demography and economy

Another very important aspect regard the health, safety and employment issues, included also the traffic trasport like vehiacle and ships movement, because their movements can really effect and have impact on the local community

Products transported



Mode of transport

