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HarmoNIA

Harmonization and Networking for contaminant assessment
in the Ionian and Adriatic Seas

HarmoNIA methodological proposals.

Part III: Harmonizing monitoring and decommissioning procedures of offshore platforms

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Contents

1. Introduction

Marine pollution may derive from the release of chemical substances in the environment from specific sea-based sources, such as shipping, mariculture, offshore oil and gas production, marine renewable energy devices, seabed mining, dredging of sediments, dumping of dredged material and historical dumping (Tornero & Hanke, 2016). These activities may threaten Good Environmental Status, which is essential for the environmental sustainability, marine socio- economic activities and the human health. In their extensive review, Tornero and Hanke (2016) have listed about 276 chemical substances that may be released into the marine environment from sea-based sources. Offshore oil/gas activities contribute to this list with the highest percentage (36%) of substances. Using offshore installations, the oil and gas industry is able to explore, extract and transport oil and gas reserves from the geologic layers situated under the seabed .

In the ADRiatic-IONian region (ADRION), there are 138 operating oil and gas platforms for exploitation of hydrocarbons (Figure 1), which are in Italian (123) and Croatian (15) waters. In addition, Montenegro, Albania and Greece have exploration and exploitation concessions along the Adriatic and Ionian coasts (Fig. 2).

Offshore operations can be classified according to two main phases: exploration phase (the work required to install and drill a well) and production phase (production of oil/gas). Rock cuttings from drilling (drill cuttings) and produced formation water (PFW) brought up with the hydrocarbons are considered as the major sources of contaminants entering the sea from regular operations (Bakke et al., 2013). In particular, PFW contains inorganic compounds (i.e. trace metals), volatile aromatic compounds (benzene, toluene, ethylbenzene, xylenes), semivolatile substances (i.e. naphthalene, phenanthrene, dibenzothiophene), phenols, organic acids and additives (Manfra et al., 2007).

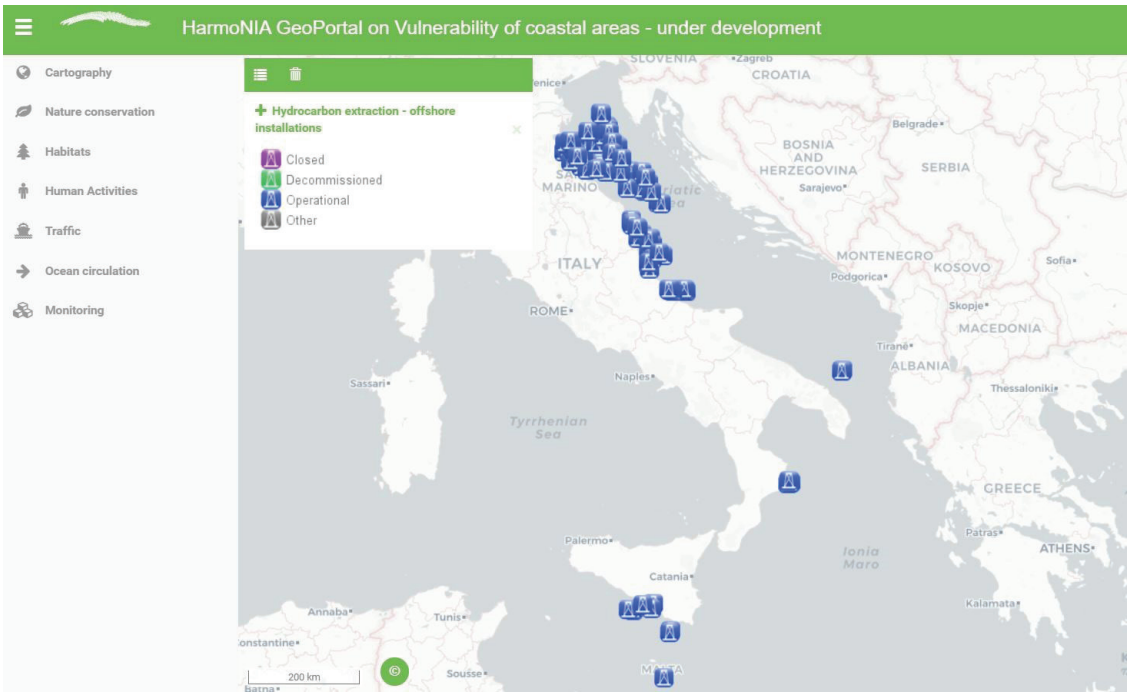


Fig. 1 Hydrocarbon extraction offshore platforms
(HarmoNIA GeoPortal on Vulnerability of coastal areas; http://jadran.izor.hr/harmonia/#)

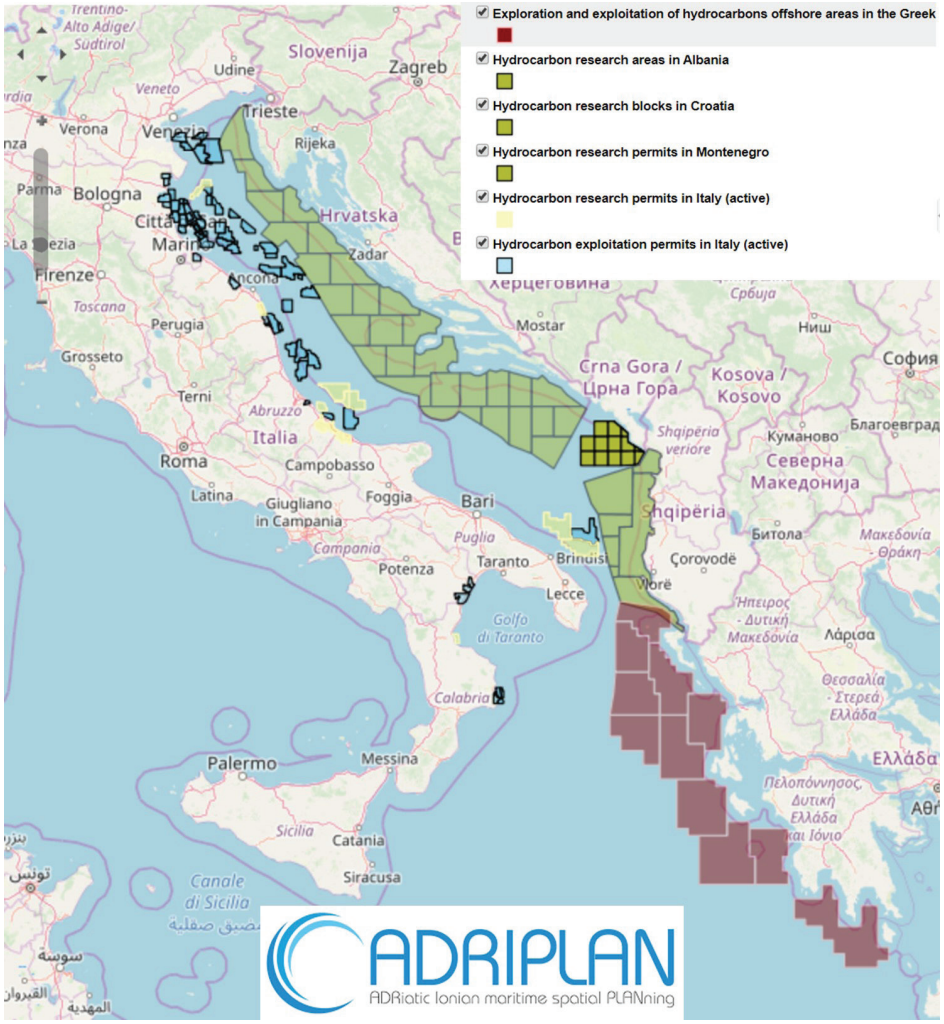


Fig. 2 Oil and gas research and exploitation permitted in the ADRION area (ADRIPLAN Data Portal; http://data.adriplan.eu/)

This kind of pollution is a key issue for the ADRION area, which is a hot spot for biodiversity that hosts natural habitats and communities of great environmental importance. Common strategies towards environmental impact assessment and good environmental status definition are recommended among countries sharing a marine region or sub-region. Transnational shared approaches need to evaluate the impact of offshore activities, by harmonizing Environmental Impact Assessment (EIA), monitoring and decommissioning procedures. HarmoNIA methodological proposals Part II: "Harmonizing Environmental Impact Assessment (EIA) procedure of offshore platform installation and produced formation water (PFW) discharge" (Manfra et al., 2020) provide information on legal aspects and technical guidelines that characterize EIA procedures in six countries of the ADRION region (Albania, Croatia, Greece, Italy, Montenegro and Slovenia) (Fig. 3).

Fig. 3 Partners of HarmoNIA Project

Here, we describe monitoring and decommissioning procedures in four of them (Croatia, Greece, Italy and Montenegro), with the aim to share an improved and harmonized approach for evaluating impacts deriving from offshore platforms in the ADRION region.

2. Synthesis of monitoring and decommissioning procedures

Information on monitoring and decommissioning procedures followed by the ADRION countries was gathered by four HarmoNIA partners. A dedicated questionnaire was shared with a specific focus on monitoring of impacts related to installation of offshore platforms and the produced formation water (PFW) discharge. Then, another questionnaire was shared to collect information about decommissioning procedures. The comparative analysis of responses obtained from Croatia, Greece, Italy and Montenegro highlights both commonalities and differences in the ADRION area, which are summarized below.

2.1 Monitoring procedures

In all countries considered, an environmental monitoring plan is mandatory for monitoring impacts due to offshore platform installation and PFW discharge. Usually, this plan is part of the Environmental Impact Assessment (EIA) procedure. The Italian legislation, in particular, requires an environmental monitoring plan specifically for the case of PFW discharge authorization (procedure not subjected to EIA).

The plan contains the strategy to be applied for monitoring potential environmental impacts due to the project (installation or PFW discharge). It is a flexible tool, which can be reformulated according to circumstances. The monitoring plan has to be related to the nature, location, size of the project and its significant environmental effects. Previous environmental monitoring datasets, when available, should be taken into consideration to modulate monitoring activities and costs.

The elaboration and application of the environmental monitoring plan is an obligation of the exploitation company and monitoring activities are usually carried out by accredited institutions or technical bodies, with specific expertise in marine environmental monitoring and protection. The company is the only responsible for covering the costs for the environmental monitoring plan, within the licensed area for exploration and exploitation of hydrocarbons.

The environmental monitoring plan aims to assess eventual negative impacts and possible hazards on the environment due to the project.

Three steps are usually followed for assessing any potential impacts:

- analysis of the Environmental Impact Study or the environmental state overview before the project;
- determination of monitoring activities to assess environmental impacts due to the project;
- application of corrective/mitigation measures and verification of their effectiveness.

The monitoring strategy includes the measurement of suitable biological, chemical and physical parameters in different matrices (e.g. water, sediment and biota).

Corrective (mitigation) measures offer prevention, reduction and elimination of significant negative impacts on the environment. Corrective actions are mentioned in the monitoring strategy in Italy and Montenegro, but not in Greece and Croatia.

Another step of monitoring procedure is the public information about the monitoring activity, its results and any corrective measures. Monitoring results are publicly shared by websites of the competent authorities or environmental protection agencies or local authorities involved.

Only in Italy there are guidelines for the preparation of the monitoring plan of the projects subject to EIA procedure, in which offshore platforms can also be included. There are also specific Italian guidelines for monitoring impacts of PFW discharge into the sea. In Table 1 are summarized the various steps followed during the monitoring procedures in the ADRION countries.

Table 1. Monitoring procedure steps followed in ADRION countries

	Croatia	Greece	Italy	Montenegro
EIA or specific authorization procedure	✓	✓	✓	✓
Monitoring plan guidelines			✓	
Mandatory & flexible monitoring plan	✓	✓	✓	✓
Common strategy	✓	✓	✓	✓
Corrective (mitigation) measures			✓	✓

Nevertheless, the main topics of the monitoring plan (e.g. sampling strategy, parameters to monitor etc.) are common among Italy, Croatia and Greece. In Montenegro, the legislation concerning these issues does not specify monitoring details, but indicates that a plan should contain parameters on the basis of which adverse environmental impacts can be identified (location, method, frequency of measuring).

In Italy, Croatia, and Montenegro the environmental monitoring plan is characterized by three phases of monitoring: pre-installation, installation, and post-installation of the offshore platform. In case of PFW discharge, the monitoring covers the period before discharging PFW into the sea and during the whole period of discharge authorization. In Greece, two phases of monitoring are required, during pre- and post-installation. An initial sampling survey is required to define baseline values (background) for environmental parameters; then, systematic monitoring is carried out, with a minimum survey frequency once per year. It is recommended that data should also be collected on a more frequent basis within the year in order to enable the assessment of trends within shorter time scales.

Generally, the survey area corresponds to the portion of the sea and seafloor in which significant impacts are expected on the environmental components due to the platform installation. This is a broader licensed area for exploration and exploitation of hydrocarbons and it includes the area close to the platform too. In the case of PFW discharge, Italian guidelines establish the survey area within a radius of 500 m from the discharge point.

In general, the sampling strategy depends on:

- expected impacts,
- size of survey area (both sea and seafloor) and its vulnerability,
- monitoring parameters,
- operation of other environmental monitoring networks,
- presence of anthropogenic and natural "external" environmental pressures (not attributable to the project) that can interfere with the monitoring results.

In particular, sampling details are established in Italian guidelines in case of platform installation and PFW discharge. Air, seawater, sediment and biota are reported as matrices potentially affected during the construction/operation of the offshore platform. In particular, in Italy water, sediment and biota are considered representative matrices of the marine environment. In Greece, information is required on physical/chemical properties and current dynamics of marine waters; local meteorology; the seabed especially for its role on the

health of marine ecosystems; parameters related to the avoidance of accidents with environmental impacts in the area closer to the platform.

A variable approach is applied within the ADRION area to define sampling frequency and parameters to monitor in water, sediment and biota. Usually, 1-2 campaigns per year are carried out for all matrices, but only Italian guidelines include sampling frequency based on project phase (installation or PFW discharge).

Specific details about parameters to be measured are most often not included in the national laws. In Greece, legislation refers to physicochemical and chemical-biological properties of marine water and analysis of metals and hydrocarbons in sediment in case of PFW discharge. In addition, Greek legislation indicates some biological analyses (assessment of ecological status of important benthic communities, including *Posidonia Oceanica,* coral and chemosynthetic meadows communities, and bioaccumulation of hydrocarbons and heavy metals in bivalves and fish), without referring to the type of impact (installation or PFW discharge). Indicators of ecosystem services that the sea offers to local societies, including fishing and tourism, are also mentioned. The Croatian legislation requires biological and toxicological analysis in mussels, while the Italian one indicates specific parameters for water, sediment and biota for monitoring the impacts of projects subject to EIA procedure (e.g. platform installation) or PFW discharge (see Annex 1).

The quality status of water column, sediment and biota is assessed on the basis of quality standards (quality limit values) reported in European Directives (WFD 2000/60/EC) and/or national laws (e.g. Legislative Decree 152/2006, Ministerial Decree 260/2010 and Legislative Decree 172/2015 for Italy). For Montenegro and Croatia, quality limit values depend on decision of the relevant authority licensed for environmental monitoring.

2.2 Decommissioning procedures

Only three Countries have registered platforms in their national waters: 125 platforms in Italian waters, 20 platforms in Croatian and 3 active licenses in Greek waters (no platforms yet in the Ionian sector). Slovenia and Montenegro have no offshore platforms.

Italy, Croatia, Greece and Montenegro have a national decommissioning legislation, conversely in Slovenia offshore hydrocarbon exploitation is forbidden by Law.

Only Italy approved and adopted national guidelines for decommissioning of the offshore platforms and related infrastructures (issued by a decree of the Italian Ministry of Economic Development in agreement with the Ministry of the Environment, Land and Sea and the Ministry of Cultural Heritage and Activities, and Tourism) to ensure the quality and completeness of the assessment of the related environmental impacts. In Greece, a three member committee sets up the monitoring plan in order to restore the environment to its original condition.

Italy and Croatia expect the decommissioning of several offshore structures in the next future. In particular, the decommissioning of at least twenty Italian offshore structures is expected during the next five years.

Only in Italy the Ministry of Economic Development publishes on its website, every year, the list of platforms to be subjected to decommissioning.

The authorities in charge for the offshore platform removal in each of the ADRION countries are:

- Italy: Ministry of Economic Development, taking into account the opinion of the Port Authority,
- Croatia: Ministry of environment protection and energy and Ministry of the sea, transport and infrastructure,
- Greece: Ministry of the Environment and Energy in agreement with Hellenic Hydrocarbon Resources

Management S.A. (HHRM S.A.),
- Montenegro: Ministry of Economy of Montenegro - Montenegro Hydrocarbon Administration.

The abandonment of offshore platforms and related infrastructures is forbidden in Italy, Greece, Croatia and Montenegro.

In these countries the companies of mining concessions, who intend to remove a platform, must present a decommissioning project to obtain the authorization from the competent authority. In these countries the decommissioning project of the platform must include environmental and technical information. In Italy, Greece and Montenegro the project plan for platform dismantling and removal includes specific details such as the structures to be decommissioned, the characteristics of the sea area affected, the method of removal, the planning and description of the removal activities and any possible remediation project. For Italy, Croatia, Greece and Montenegro the projects for platform removal are subject to Environmental Impact Assessment (EIA) procedures.

In Table 2, the procedures for platform decommissioning followed by each ADRION country is reported.

Table 2. Decommissioning procedures followed in ADRION countries

	Croatia	Greece	Italy	Montenegro
Existing platforms in the ADRION seas	✓		✓	
National legislation	✓	✓	✓	✓
Guidelines			✓	
Forbidden abandonment	✓	✓	✓	✓
EIA for removal	✓	✓	✓	✓
Monitoring during removal	✓	✓	✓	✓
Restoration measures		✓	✓	✓
Partial removal, alternative use (re-use)	✓	✓	✓	
EIA for re-use		✓	✓	

All countries require an environmental monitoring during the removal activities. For Italy, Greece and Montenegro the environmental restoration of the areas affected by the platform removal (at the end of the removal activities) is mandatory.

In Italy, Greece, Croatia and Montenegro an inspection by the competent Authority, verifies the platform removal, in compliance with the authorized project, and draws up the certification of cessation of mining activity.

In Italy and Greece, the companies interested in reusing offshore platforms have to submit a preliminary project of reuse to the competent authority. In Italy and Greece, the projects for the reuse of offshore platforms are subjected to an EIA. In Croatia, national regulatory framework doesn't provide specific provisions for the reuse but the projects should be subject to EIA. In Italy, the applicant must request a maritime concession for the occupation and use of the area authorized for platform reusing.

In Italy and Greece, the competent authority could adopt a negative conclusion of the provision, determining the rejection of the request, if there are one or more dissenting acts, which cannot be overcome.

3. Methodological proposal

On the basis of the transnational comparison in the ADRION region, it appeared that a quasi-similar approach is followed by four ADRION countries for monitoring the impacts due offshore platforms. In Italy, detailed guidelines are in place for monitoring the impacts of projects subject to environmental impact assessment (EIA) procedure (e.g. platform installation) and PFW discharge. The Italian environmental monitoring plan is the result of almost twenty years of experience to assess potential environmental impacts linked to offshore platforms, by monitoring activities and laboratory analyses. Regarding platform removal, only Italy and Croatia expect the decommissioning of several offshore structures in the next future. Due to limited experience, the harmonization of decommissioning procedures is still an open challenge in the ADRION region.

Here, we propose to share a transnational harmonization of monitoring procedures for impacts due to offshore platforms.

The following topics may be considered for the elaboration of a harmonized environmental monitoring plan:

- defining the survey area,
- sampling phases,
- sampling design,
- matrices to investigate,
- parameters to measure,
- sampling frequency

For each topic, we report the considerations shared among the partners involved in the HarmoNIA project.

Survey area

The survey area may be the broader licensed area for exploration and exploitation of hydrocarbons and it may also include the area close to the platform. In case of PFW discharge, the survey area should be within a radius of 500 m from the discharge point.

Sampling phases

The plan may take into account the following three phases of monitoring:

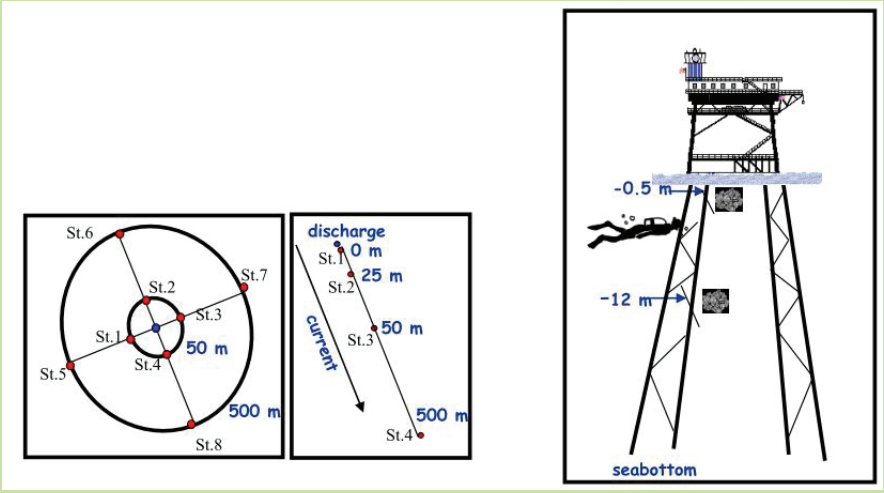
- pre-project: an initial sampling survey to define background/baseline values for environmental parameters before the project;
- during project: a sampling during implementation of the project, if possible, to define possible alterations within shorter time scales;
- post-project: a final monitoring to enable the assessment of trends of possible alterations within shorter and longer time scales.

In case of PFW discharge, the monitoring covers the whole period of discharge authorization.

Sampling design

In order to investigate the impact of the platform structure, a radial sampling pattern can be selected for all matrices, allocating stations around the platform according to fixed distance from it (Fig. 4(a)), rather

than using a randomized placement. Further stations can be included, if vulnerable ecosystems are near the platform. This sampling design is considered more appropriate for tracing any environmental changes when the point source of disturbance is known (e.g. installation). In regard to PFW discharge impact, the water samples can be collected along a transect taking into consideration local hydrodynamics, if possible, that may affect PFW dispersion from the point of discharge, while sediment can be collected along a transect oriented towards the dominant current (Fig. 4 (b)). Stations for biota collection may be close to platform pylons (Fig. 4 (c)). Furthermore, in order to obtain an exhaustive rigorous environmental framework, all matrices should be sampled also in a control area, presenting the same geo-morphological characteristics of the investigated area, but not directly influenced by the offshore activities.



(a) (b) (c)

Fig. 4 (a) Radial grid of sampling stations; (b) water & sediment stations along a transect from the PFW discharge point; (c) biota sampling at the pylons

Matrices to investigate

All matrices potentially affected by the projected activity have to be monitored. In particular, water, sediment and biota in marine environment; optionally, air might be monitored too.

Parameters to investigate

The harmonized environmental monitoring plan proposes to monitor a set of parameters (listed in Annex 2) in order to control potential impacts (due to the project) on the marine ecosystem.

The plan couples information on physical, chemical and biotic variables to give the best description of the environmental quality status. In addition, it is suggested to consider numerical modelling for the following purposes: a) as one of the first steps in the design of monitoring programme of PFW discharge for a prevention-first policy; b) as one of monitoring tools for assessing risk associated to PFW dispersion into the sea. Annex 2 reports a list of recommended parameters that should be analyzed for monitoring impacts of offshore platform installation and PFW discharge into the sea. In particular, only the core parameters which are essential for monitoring impacts of installation were chosen among those reported in Italian guidelines and in Norwegian guidelines for monitoring impacts of projects subjected to EIA procedure.

Sampling frequency

Proposed sampling frequency consists of:

- one or two sampling campaigns before the installation of the platform or before the beginning of PFW discharge;
- two sampling campaigns, during the first year of the platform life, or after the beginning of PFW discharge, aimed at capturing the conditions before and after winter mixing of the water column;
- one survey, scheduled for each following year of activity, to monitor both types of impacts.

4. Conclusions

The harmonized environmental monitoring plan sets the basis towards the adoption of common procedures to monitor potential impacts due offshore platforms on the marine ecosystem, in the ADRION region.

Physico-chemical analyses, ecotoxicological assays, bioaccumulation measurements, ecological investigations, together with numerical modelling studies, may provide the necessary information for assessing spatial and temporal perturbations occurring in the marine ecosystem.

In the framework of an ecosystem approach, as recommended by the latest most innovative legislation in the field of environmental monitoring, a harmonized environmental monitoring plan provides a useful tool for collecting and integrating consistent and compatible marine datasets at ADRION level.

5. References

Bakke, T., Klungsøyr, J., Sanni, S. 2013. Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry. Marine Environmental Research 92, 154-169.

DIRECTIVE 2014/52/EU The Environmental Impact Assessment (EIA) Directive amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment 25.4.2014

Manfra, L., Moltedo, G., Virno Lamberti, C., Maggi, C., Finoia, M.G., Gabellini, M., Giuliani, S., Onorati, F., Di Mento, R., Cicero, A.M., 2007. Metal content and toxicity of produced formation water (PFW): study of the possible effects of the discharge on marine environment. Archives of Environmental Contamination and Toxicology 53, 183–190.

Manfra L., Ceracchi S., Virno Lamberti C., Trabucco B., Bertolini S., Cara M., Castelli A., Di Mento R., Dobnikar Tehovnik M., Fafandjel M., Giorgi G., Ivanković D., Joksimovic D., Katsidima L., Kolitari J., Lipizer M., Mitric M., Papazisimou S., Parinos C., Lo Russo C., Rotini A., Velikonja M., Virno Lamberti C., Zeri C., Žilić L., 2020, HarmoNIA methodological proposals Part II: Harmonizing Environmental Impact Assessment (EIA) procedure of offshore platform installation and produced formation water (PFW) discharge, 12 pp. doi: 10.6092/1d048334-b873-47f6-b45a-10ca3d871c61

Tornero V., Hanke G., 2016. Chemical contaminants entering the marine environment from sea-based sources: A review with a focus on European seas. Marine Pollution Bulletin, 112, 17 – 38, http://dx.doi.org/10.1016/j.marpolbul.2016.06.091.

Annex 1: Parameters for monitoring impacts of projects subject to EIA procedure and PFW discharge into the sea according to Italian guidelines.

Monitoring of the impact of PFW discharge	Monitoring of the impact of the offshore platform installation
Water column salinity, temperature, density, pH, transmittance, current[1], fluorescence (chlorophyll), dissolved oxygen, nutrients[2], total hydrocarbons, aliphatic hydrocarbons[3], BTEX[4]	*Water column* current, temperature, salinity, density, turbidity, dissolved oxygen, chlorophyll (fluorescence), pH, suspended matter
Sediment macroscopic (visual and descriptive) analysis, grain size, total organic carbon , total hydrocarbons, aliphatic hydrocarbons[3], BTEX[4], polycyclic aromatic hydrocarbons (PAHs)[5], metals[6]	*Sediment* grain size, percentage of humidity, specific gravity, metals (Hg, Cd, Pb, As, total Cr, Cu, Ni, Zn, Mn, Al and Fe), total hydrocarbons, PAHs, PCBs, organochlorine pesticides, butyltin compounds (tributyltin , dibutyltin , monobutyltin), total organic matter, total nitrogen and phosphorus, total organic carbon , microbiological parameters (total and fecal coliforms, fecal streptococci), ecotoxicological assays Further parameters can be added according to the type of work and the potential impact expected in the EIA report others (e.g. Se, Ba, V)
Biota (by catching platform leg mussels or mussel cages) lipid content, total hydrocarbons, aliphatic hydrocarbons, BTEX[4], polycyclic aromatic hydrocarbons (PAHs)[5], metals[6]	*Biota* (by catching platform leg mussels) metals (Hg, Cd, Pb, As, total Cr, Cu, Ni, Zn, and Fe), PAHs, PCBs, organochlorine pesticides, butyltin compounds (tributyltin , dibutyltin , monobutyltin), Further parameters can be added according to the type of work and the potential impact expected in the EIA report (e.g. Ba, Se, V, halogenated compounds, etc.), biomarkers, fish assemblages analysis, macrozoobenthic community analysis, visual census of cetaceans
PFW pH, total suspended matter, temperature, total nitrogen, nutrients[2]*, sulphates, sulphides, sodium chloride, salinity, metals[6]*, mineral oils, total organic carbon (TOC), dissolved organic carbon (DOC), particulate organic carbon (POC), biochemical oxygen demand (BOD5), organic aromatic solvents, aliphatic hydrocarbons > C12, hydrocarbons < C12, diethylene glycol, other declared additives	*Sea bottom* bathymetry and morphology

[1] current measurements at the PFW discharge depth to identifying the direction of the sampling transect
[2] Ammonia, nitrites and nitrates as nitrogen, phosphate as phosphorus in dissolved phase (*for PFW: ammonia, nitrites and nitrates as nitrogen)
[3] C_6-C_{12} and C_{12}-C_{20}
[4] Benzene, Toluene, Ethylbenzene, o,m,p-Xylene
[5] Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Crysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Indenopyrene
[6] Lead, Vanadium, Chromium, Barium, Copper, Iron, Mercury, Arsenic, Cadmium, Zinc, Nickel (*for PFW all these metals without Vanadium and Barium to be determined in total and particulate phase)

Annex 2: List of recommended parameters that should be analyzed for monitoring impacts of offshore platform installation and PFW discharge into the sea.

Monitoring of the impact of PFW discharge	Monitoring of the impact of the offshore platform installation
Water column salinity, temperature, density, pH, transmittance, turbidity, fluorescence (chlorophyll), dissolved oxygen, current[1], nutrients[2], suspended matter, total hydrocarbons, aliphatic hydrocarbons[3], BTEX[4], phenols, ecotoxicological assays, passive sampling, PFW dispersion model	*Water column* current, temperature, salinity, density, turbidity, dissolved oxygen, chlorophyll (fluorescence), pH, suspended matter, transmittance, BTEX, total hydrocarbons, aliphatic hydrocarbons, phenols, passive sampling
Sediment macroscopic (visual and descriptive) analysis, grain size, total organic carbon (TOC), total hydrocarbons, aliphatic hydrocarbons[3], BTEX[4], polycyclic aromatic hydrocarbons (PAHs)[5], metals[6], phenol, ecotoxicological assays	*Sediment* grain size, percentage of humidity, specific gravity, metals (Hg, Cd, Pb, As, total Cr, Cu, Ni, Zn, Mn, Al and Fe), total hydrocarbons, PAHs, butyltin compounds (tributyltin , dibutyltin , monobutyltin)[7], total organic matter, total nitrogen and phosphorus, total organic carbon, microbiological parameters (total and fecal coliforms, fecal streptococci), ecotoxicological assays, others (e.g. Se, Ba, V), BTEX, phenols
Biota (by catching *M. galloprovincialis* individuals on the platform legs or mussel cages) lipid content, total hydrocarbons, aliphatic hydrocarbons, BTEX[4], polycyclic aromatic hydrocarbons (PAHs)[5], metals[6]	*Biota* (by catching platform leg mussels/polychetes) metals (Hg, Cd, Pb, As, total Cr, Cu, Ni, Zn, and Fe) others (e.g. Ba, Se, V), IPA, butyltin compounds (tributyltin , dibutyltin , monobutyltin)[7], fat content, biomarkers, fish assemblages analysis, macrozoobenthic community analysis, visual census of cetaceans
PFW pH, total suspended matter, temperature, total nitrogen, nutrients[2]*, sulphates, sulphides, chlorides, salinity, metals[6]*, mineral oils, total organic carbon (TOC), dissolved organic carbon (DOC), particulate organic carbon (POC), biochemical oxygen demand (BOD5), organic aromatic solvents, aliphatic hydrocarbons > C12, hydrocarbons < C12, diethylene glycol, other declared additives, PAHs, phenols, ecotoxicological assays, radionuclides (^{226}Ra, ^{228}Ra, ^{210}Pb in certain cases, also ^{228}Th)	*Sea bottom* bathymetry and morphology

[1] current measurements at the PFW discharge depth to identifying the direction of the sampling transept
[2] Ammonia, nitrites and nitrates as nitrogen, phosphate as phosphorus in dissolved phase (*for PFW: ammonia, nitrites and nitrates as nitrogen)
[3] C_6-C_{12} and C_{12}-C_{20}
[4] Benzene, Toluene, Ethylbenzene, o,m,p-Xylene
[5] Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Crysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Indenopyrene
[6] Lead, Vanadium, Chromium, Barium, Copper, Iron, Mercury, Arsenic, Cadmium, Zinc, Nickel (* for PFW all these metals without Vanadium and Barium to be determined in total and particulate phase)
[7] The butyltin compound should be recommended particularly in the old platforms tributyltin as biocides in antifouling paints were used
Note: stable isotope ratio of carbon, nitrogen and sulphur in dissolved, particulate and sediments may be analyzed in order to trace the eventual contamination source in case of impact of platform installation and PFW discharge