WP 5 - Testing-Monitoring surveys on site
“PILOT MONITORING PLAN FOR PORT BOURGAS”
(Draft)

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The present environmental pilot monitoring plan (PMP) of Port Bourgas is prepared in relation to the Project Environmental Management of Trans-border Corridor Ports /ECOPORT 8/ under Operative Programme for Trans-National Cooperation in South-East Europe by Bulgarian Ports Infrastructure Company (BRICo) and department “Water Use and Management” of the National Institute of Meteorology and Hydrology at Bulgarian Academy of Sciences, NIMH-BAS (previous Institute of Water Problems – BAS) according to the ECOPORT8 Working program package 5 (WP5): Testing Monitoring Surveys, requirements of GENERAL Monitoring Plan (GMP) for ECOPORT 8 and results from investigations of WP 4: Context analysis. The PMP of port Bourgas is up to the requirements and conditions of EU and Bulgarian legislation too.
CONTENTS

1. Introduction .................................................................................................................. 4

2. Legal and regulation basis of monitoring................................................................. 5

3. Current port structure and environment conditions .............................................. 14
  3.1. Current port structure ......................................................................................... 14
  3.2. Environment conditions ..................................................................................... 18
  3.3. Existing port monitoring system ........................................................................ 20

4. Main parameters for environmental assessment in the port ............................ 22
  4.1. Previous investigations ..................................................................................... 22
  4.2. Selection of methodological coherency in monitoring ........................................ 24
  4.3. Main parameters for environmental assessment in the port .......................... 29
    4.3.1. Marine waters ............................................................................................ 30
    4.3.2. Air ............................................................................................................ 31
    4.3.3. Sea sediments ........................................................................................... 32
  4.3.4. Others (noise, garbage, consumptions) ....................................................... 33

5. Number of monitoring points and frequency of monitoring investigation............ 36
  5.1. Justification of the monitoring points and frequency in terms of perspective development and gained port experience ....................................................... 36
  5.2. Proposed parameters in monitoring points (stations) ................................. 38
  5.3. Frequency of monitoring investigations ........................................................... 40
    5.3.1. Marine waters and sediments .................................................................. 40
    5.3.2. Atmospheric air ....................................................................................... 41
    5.3.3. Noise ....................................................................................................... 41

6. Methods of analysis, processing and presentation of monitoring results............. 41

7. References .................................................................................................................. 41

Appendix № 1 – Table of monitoring parameters, methods for their analysis, equipment and place of analysis execution – marine waters and sediments .......................................................................................... 43
Appendix № 2 - Schedule of executed monitoring investigations ............................ 47
1. Introduction

The environmental monitoring is one of the main concerns and tasks of the ECOPORT 8 project. The purpose of the monitoring is following by the first strategic goal of a common ECOPORT8 strategic environmental approach (see Final report WP4 Ch.8):

- to assess the current environmental status of the port waters, air, sediments and maritime habitats and to identify in detail significant environmental impacts from port activities and ships in ports and in port regions nearby the port.

It is essential for detecting in advance any environmental pollution caused by port activities and planning and implementing anti-pollution measures and activities. This pilot monitoring plan (PMP) in one of ports of Corridor 8 aims to collect current information for the condition of main parameters, determining sea water quality, atmospheric air and any possible impact on them by the port activities in the port. Such approach will allow initiating corrections in the technological operations for environmental protection and will support port management.

The developed concept of the project entirely overlaps with the main normative documents in this sphere in the Republic of Bulgaria, viz. Regulation No.5 of MOEW from 23.04.2007 on water monitoring and Regulation on the protection of marine environment. Programmes for execution of surveillance (control) and operational monitoring and, if necessary, of investigative monitoring are elaborated in compliance with the Regulation on monitoring (Article 8, par.1). According to Article 9 (1) the surveillance monitoring programme provides information which is necessary for performing assessment of the overall condition of surface water bodies, as well as for:

1. supplementing and validating the results from the review of the impact from human activity and risk assessment;
2. design of future monitoring programmes;
3. assessment of long-term changes in natural conditions;
4. assessment of long-term changes resulting from widespread anthropogenic activities.

The duration of the surveillance monitoring is one year and the same duration is envisaged for the measurements under the Ecoport 8 project. The tasks set in the project correspond entirely to the purposes cited above and specified in the Regulation on surveillance monitoring. The obtained results will settle the initial database to verify the significant aspects and environmental impacts and become a base for elaboration of establishment of tools, methods and good practices and thus will face the challenges and opportunities linked to environmental issues dealt with by port authorities.

Realization of the monitoring plan includes the following stages:

- Analysis of the current situation in Port Burgas;
• Determining Sensitive parameters and methodology for the monitoring program;
• Sampling program design, including selection of sampling points, determination of sampling frequency, selection of measurement technique and equipment for each sensitive parameter;
• Description of Pilot Monitoring Plan (PMP) procedure;
• Recommendations for the implementation of the Pilot Monitoring Plan.

The essence of the monitoring is also to assess environmental parameters not only on the port but and on the adjacent coast waters with good collaboration between the respective controlling bodies and exploitation companies to prevent potential negative impacts. Within the plan framework it is envisaged to implement a system for automatic measurement of the part of environmental parameters. The system will be used for execution of environment self monitoring at the port of Bourgas following methodology which will be common and identical for the participants in the ECOPORT8 project. The aim is to improve the quality of the port of Bourgas and ports of the SEE area and to prepare of a good basis for the port authorities organizations to acquire environmental certification.

2. Legal and regulation basis of monitoring

The first step of monitoring plan development is to consider some main issues clarifying and standardizing some concepts on the basis of regulative documents and legislation in the Republic of Bulgaria in relation to port’s territory and aquatory, as well as the available normative basis for assessment of sea water condition and execution of monitoring investigations.

Definition of the port’s nature and its components is given in the Law on the maritime spaces, inland waterways and ports of the Republic of Bulgaria, prom. SG 12/11.02.2000, amended and supplemented several times, the last amendment being SG 81/13.10.2009 [1].

In Article 6 (2) of the law it is stated that the internal sea waters of the Republic of Bulgaria comprise besides the other components, the waters of the ports, bounded on the seaward side by the line, joining the outermost points in the sea of anchorages, water supply installations and other permanent port facilities;

In Article 92 (amend. SG 24/2004) it is stated that (1) A port is an area that comprises an aquatory, a territory and an infrastructure at the Black Sea coast, is located on the territory of one or more municipalities and unites natural, artificial and organizational conditions for safe berth, stay and ship servicing; (2) Ports connect the water spaces of the Republic of Bulgaria to land roads and/or railway transport network.
In Article 92а.(1) it is stated that the aquatory of the ports is exclusively a state property, whereas in (2) it is stated that the territory and infrastructure of the ports can be property of the state, municipalities, natural and juridical persons.

In the additional provisions to the same law it is stated written that “Aquatory of a port” is the adjacent to the port territory water area with natural or artificial conditions for protection from waves and silting up, which possesses the necessary area and depth for safe maneuvering and berthing of the largest ship foreseen for the respective port.

On the basis of these definitions the Port of Bourgas aquatory is the sea territory confined within the protective walls (breakwaters) and quay walls servicing the respective berths where loading-unloading activities are carried out.

According to Article 103 (amended SG 24/2004) (2) Public transport ports should have at least the following natural, artificial and organizational conditions:
1. aquatory;
2. safe roadsteads, quays or moorings allowing ship anchoring, approaching and mooring in order for them to perform their operations under the necessary safe conditions;
3. operative zone, intended for execution of loading-unloading activities;
4. railway and/or road approaches providing connection with road network and railway infrastructure;
5. organization allowing effective servicing of ships and their crews;
6. (amend. SG 104 from 2005, SG 98 from 2008) plan for waste reception and processing, including the possibility for signing contracts with suppliers of services for reception of waste from shipping activity, as well as suitable port reception facilities.

In the additional provisions to the same law p.47 (new – SG 65/2006) the concept “ecological condition of the surface waters” is specified: it is the condition of the surface water body assessed through the values of the biological elements for quality and the hydrochemical and hydromorphological elements.

In p.11 of the additional provisions to the law it is stated that pollution of the marine or river environment shall mean direct or indirect introduction by man of substances or power into the marine environment, including the river mouths, which causes or might cause harm to the living marine or river resources, risk to the human health, impede lawful exploitation of the sea by also deteriorating the quality of the sea water and the conditions for tourism and recreation, in accordance with the norms and standards of admissible pollution in force.

The present monitoring plan should comply with Regulation No.5 on water monitoring [2], Regulation No.8 [3] on the quality of coastal marine waters, Regulation on protection of marine environment, as well as with the

Regulation No.5 of 23.04.2007 on water monitoring issued by the Minister of Environment and Water, prom. SG 44/5.06.2007, in force since 5.06.2007 [2] regulates the order and way for monitoring planning and for establishment of networks for monitoring of waters in each area for basin management on the territory of the state, as well as for execution of activities for their exploitation, maintenance, communication provision and laboratory-information servicing.

In Article 47 (1) of the Regulation it is specified that the Black Sea monitoring network consists of:
1. stations and points for observation of ecological and chemical condition of coastal marine waters and sediments;

In fact it is specified in the Regulation that these stations and points for observation of coastal waters should be at certain distance from the beach, out of the scope of the direct influence of coast area. However, in our monitoring the port waters are immediate part of the sea territory adjacent to the coastline and this Regulation do not apply to port waters but the directions given in R5 are used due to lack of other normative documents for sea ports in the country.

Article 48 (1) The Black Sea monitoring network shall provide:
1. classification of the condition of the water bodies in coastal marine waters;
2. risk assessment;
3. assessment of the long-term changes in the natural conditions;
4. analysis and assessment of the efficiency of existing monitoring networks;
5. assessment of the changes in water bodies condition specified to be at risk, in response to the application of measures for improvement and/or prevention of deterioration;
6. clarification of the reasons why water bodies do not achieve the purposes when the reasons are not known;
7. determination of the scope and impact of incidental pollutions;
8. use for the intercalibration process;
9. protected territories preservation;
10. determination of reference conditions.

(2) The number and location of the stations and points are determined in such a way that the monitoring in them shall ensure provision of sufficient and reliable information for the condition of marine waters in terms of time and territory considering the changes in natural conditions and the impact of human activity.

Regulation No.8 from 25.01.2001 on the quality of coastal marine waters issued by the Minister of Environment and Water, Minister of Regional Development and Public Works and the Minister of health, prom. SG 10/2.02.2001[3] is used for assessment of marine qualities in the country. This
regulation determines the parameters and norms with which the coastal seawater qualities should comply.
In Article 3 of the Regulation it is stated that coastal marine waters include:
1. areas of existing and perspective use of waters in resort areas, sport bases and areas for treatment and prophylaxis with regulated areas for bathing, areas for development and reproduction of aquacultures, as well as areas with unique ecosystems;
2. sanitary protection zones.
Article 7. The sanitary protection zone shall provide the maintenance of necessary conditions for sustainable functioning of the ecosystems in coastal marine waters. It ensures protection of water quality in the areas of existing and perspective use of physico-chemical, microbiological, biological and radiological pollution as a result of waste water discharge in the sea.
Article 8. The boundaries of the sanitary protection zone along the coast line are determined between the approved areas of existing and perspective use of waters and in the direction of the open sea – up to the boundary of the coastal marine waters of the Republic of Bulgaria.
Article 10. The norms and parameters for coastal marine water quality in the area of existing and perspective use of waters and in the sanitary protection zone are specified in appendix.
This appendix is the basis for choice of parameters which should be comply with during elaboration of the present pilot monitoring plan.

In Regulation No.5, Article 71 it is stated that the analyses of samples shall be executed by accredited laboratories. In Regulation No.8 this is confirmed again in Article 12. The values of parameters for coastal marine water quality are determined by accredited laboratories, determined by Bulgarian standards and where there are no such standards – by methods, and if necessary – by test procedures, approved by the Minister of Environment and Water.

The Black Sea region for basin management with centre Varna comprises:
1. Water catchment areas of the rivers flowing into the Black Sea from the northern to the southern border,
2. Territorial sea of the Republic of Bulgaria, including internal seawaters.
Territorial sea includes 12-mile sea aquatory with an area of 6,358 sq.km in front of the Black Sea coastline from Sivriburun Cape to the north to Rezovska River to the south, with a total length of 378 km.

The presence of the Black Sea determines the uniqueness of the basin management region. It is one of the largest internal seas in the world. Its only connection with the World Ocean is via the Mediterranean Sea through the Marmara Sea, Bosphorus and Dardanelle straits. The salinity of the Black Sea (18 ‰) is almost twice less than that of the World Ocean due to the limited water inflow from the Mediterranean Sea through the Bosphorus as a result of its small depth (70 m) and width (700 m). Another peculiarity is the inflow of 1/3 of the waters from Europe, including the three large European rivers: Danube, Dnepar and Don. Their river valleys pass through 30 towns with total population of 160 million people on the territory of 17 countries.

Through the inflow of the above mentioned rivers biogens with high concentration enter the Black Sea which causes intensive eutrophication processes. Below 100 m depth the sea water layer contains 11-14 ml/l of toxic hydrogen sulphide which is the reason for absence of life below this depth with the exception of some bacteria. In spite of this the Black Sea has relatively high biological diversity and live natural resources. The Black Sea coast is divided among six countries – Bulgaria, Georgia, Romania, Turkey, Russia and Ukraine. The length of the coastlines is the following: Bulgaria – 378 km,
Georgia – 310 km, Romania – 225 km, Russia – 800 km, Turkey – 1 329 km and Ukraine – 2 782 km.

Generally, the most specific and significant impacts identified on the waters in the Black Sea basin region are those connected with pollution of untreated waters, farming practices, unregulated landfills, solid domestic waste depots, morphological changes, etc. These problems are caused to a large extent by various economic activities. The identified significant problems enabled definition of purposes and specification of measures for achieving good water status.

The Water Framework Directive introduces the concept “reference conditions”, as well as an approach for the normative assessment of the water bodies status.

Reference conditions are described as conditions of the environment and water ecosystems similar to those unaffected by anthropogenic activity. These are not necessarily conditions corresponding to total lack of anthropogenic impact, but these are conditions allowing such impact which has minimal or no impact on water ecosystem. The degree of difference between reference conditions and actual condition is expressed through ecological quality ratios (EQR). These ratios represent the relationships between the values of parameters and indexes used for observation and assessment of the actual condition of all biological quality elements, the main physico-chemical parameters and hydromorphological quality elements and their values in the reference conditions (high status). Thus a scale of values is created expressing the boundaries between various conditions – a system for ecological classification of water bodies. Since different types of water bodies have their own peculiarities which determine difference in the characteristics of their water ecosystems, it is necessary to determine type-specific reference conditions. This necessity is used as a requirement in Directive 2000/60/EC. Establishment of reference conditions is a key issue in the water management process. They should be used as a standard representing the best possible status of the ecosystem to which its present status should be compared. The degree of difference established between the reference conditions and the current status determines the assessment of the ecological status along a scale of 5 degrees: “high”, “good”, “moderate”, “poor”, “bad” and the reference conditions coincide with high water body status.

This can be used for assessment of the impact which various anthropogenic activities exert on water ecosystem status.

Directive 2000/60/EC allows for the reference conditions to be established through: identification of contemporary reference sites (unaffected or slightly affected area) and collection of necessary data from them, analysis of background information (for past periods which offered reference conditions), through modeling and/or expert assessment.

Three reference categories are introduced to facilitate handling of potential points for reference conditions (elaboration under a project under Operational
Programme Environment “Determination of reference conditions and maximum ecological potential for surface water types on the territory of the Republic of Bulgaria” according to REFCOND Guide 2003):

Reference conditions – Corresponding to the main requirements for reference conditions, 3 years of validation with real data (biology, hydromorphology, physico-chemistry) are pending. Until full validation completion the point is a provisionally reference point.

Close to reference conditions – The point shows small deviations from the reference conditions but can be used for definition of reference conditions.

Provisionally reference point – There are no real reference conditions for the respective type and the best available points are used as status. In this case a starting point for modeling the respective type-specific conditions is determined.

The concepts for various monitoring types according to the purposes and tasks pursued are specified in the Regulation and strategy as well.

**Surveillance monitoring**

The purpose of the surveillance monitoring is to provide necessary information for:

- supplementing and validating the results from the review of the impact from human activity and risk assessment;
- design of future monitoring programmes;
- assessment of long-term changes in natural conditions;
- assessment of long-term changes resulting from widespread anthropogenic activities.

The results from the surveillance monitoring are reviewed and used together with the results from analysis of anthropogenic impact and pressure in order to determine the requirements for the current and subsequent Plans for river basins management.

Surveillance monitoring is executed in water bodies determined as “not being at risk” or “probably at risk” with the purpose of supplementing the necessary information to determine their status.

**Operational monitoring**

The purpose of the operational monitoring is:

- to determine the status of those water bodies which are at risk with respect to achieving the purposes of Water Framework Directive;
- to assess any changes in the status of bodies at risk resulting from the execution of the programme of measures.

The operational monitoring programme can be amended during the period of the management plan depending on the information obtained in relation to the analysis of anthropogenic impact and pressure or from the executed monitoring.
This may include, in particular, reduction of monitoring frequency at sites where impact is not considerable or the respective anthropogenic pressure is eliminated.

The operational monitoring observes only parameters which are indicative for the quality elements – most sensitive to the pressure to which the respective water bodies are subject.

On the basis of the information accumulated the possible schemes of assessment are introduced that is shown in Fig.2:

**Fig. 2. Assessment of environmental status**

Biological elements are the most important ones during ecological status assessment. During surveillance monitoring it is possible to determine biological elements that are most sensitive to the respective anthropogenic pressure and subsequently to use them during operational monitoring.

To assess the degree of pressure on the respective surface waters, including marine waters, quality elements indicative of pressure are used. They can be the following:
1. Parameters indicative of the biological quality element or elements that are most sensitive to pressure to which waters are subject.
2. All discharged priority or priority hazardous substances and other pollutants discharged in considerable quantities.
According to Regulation No.5, besides surveillance and operational monitoring, investigative monitoring should be executed if necessary. It is executed when the reason for exceedings of environmental quality standards is unknown, in cases when surveillance monitoring shows that there is no possibility for the purposes for environmental protection to be achieved and operational monitoring has not started yet, with the aim to check the reasons due to which the water body will not achieve the defined purposes and to specify the degree and impact of accidental pollutions.

The main sampling parameters and frequency are specified in the Regulation according to the type of performed monitoring.

The main physico-chemical parameters of surface waters specified in the Plan for management of waters in the Black Sea basin region are listed in the Table 1 below:

<table>
<thead>
<tr>
<th>No.</th>
<th>I</th>
<th>No.</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>1</td>
<td>Total Nitrogen</td>
</tr>
<tr>
<td>2</td>
<td>Temperature</td>
<td>2</td>
<td>Total Phosphorus</td>
</tr>
<tr>
<td>3</td>
<td>Suspended substances</td>
<td>3</td>
<td>Calcium</td>
</tr>
<tr>
<td>4</td>
<td>Transparency (Secchi disk)**</td>
<td>4</td>
<td>Magnesium</td>
</tr>
<tr>
<td>5</td>
<td>Chlorophyll “A”***</td>
<td>5</td>
<td>Total hardness***</td>
</tr>
<tr>
<td>6</td>
<td>Electrical conductivity</td>
<td>6</td>
<td>Total Iron</td>
</tr>
<tr>
<td>7</td>
<td>Dissolved Oxygen</td>
<td>7</td>
<td>Manganese</td>
</tr>
<tr>
<td>8</td>
<td>Oxygen saturation in %</td>
<td>8</td>
<td>Calcium carbonate hardness</td>
</tr>
<tr>
<td>9</td>
<td>BOD₅</td>
<td>9</td>
<td>Hydrogen sulphide***</td>
</tr>
<tr>
<td>10</td>
<td>COD</td>
<td>10</td>
<td>Total Organic Carbon</td>
</tr>
<tr>
<td>11</td>
<td>Ammonium Nitrogen – N-NH₄</td>
<td>11</td>
<td>Silicon**</td>
</tr>
<tr>
<td>12</td>
<td>Nitrate Nitrogen – N-NO₃</td>
<td>12</td>
<td>Salinity, ‰ **</td>
</tr>
<tr>
<td>13</td>
<td>Nitrite Nitrogen – N-NO₂</td>
<td>13</td>
<td>Turbidity (FNU/NTU)**</td>
</tr>
<tr>
<td>14</td>
<td>Orthophosphates – P-PO₄</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Chlorides</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Sulphates</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>NO₃</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ammonium ion</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Kjeldahl Nitrogen</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

* Monitoring frequency – once per three months
** For lakes and coastal marine waters and Danube River
*** These parameters are analyzed if necessary and according to the assessment of Black Sea Basin Directorate
Proposal for a national classification system for surface water quality for the purposes of analysis of anthropogenic impact and pressure is given in Table 2.

### Table 2

<table>
<thead>
<tr>
<th>Limit values</th>
<th>High</th>
<th>Good</th>
<th>Moderate</th>
<th>Poor</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>oxide/biogenic regime</td>
<td>Unit</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>Temperature</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>mg/l</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>BOD₅</td>
<td>mg/l</td>
<td>&lt;2</td>
<td>&lt;3.5</td>
<td>&lt;7</td>
<td>&lt;18</td>
</tr>
<tr>
<td>pH (acids)</td>
<td>-</td>
<td>&gt;6.5</td>
<td>&gt;6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH (bases)</td>
<td></td>
<td></td>
<td>&lt;8.5</td>
<td>&lt;9.0</td>
<td></td>
</tr>
<tr>
<td>NH₄ Ammonium Nitrogen</td>
<td>mg/l</td>
<td>0.05</td>
<td>0.3</td>
<td>0.6</td>
<td>1.5</td>
</tr>
<tr>
<td>NO₂ Nitrite Nitrogen</td>
<td>mg/l</td>
<td>0.01</td>
<td>0.06</td>
<td>0.12</td>
<td>0.3</td>
</tr>
<tr>
<td>NO₃ Nitrate Nitrogen</td>
<td>mg/l</td>
<td>0.8</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>PO₄ Orthophosphates</td>
<td>mg/l</td>
<td>0.05</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>mg/l</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td>Chlorophyll-a</td>
<td>mg/l</td>
<td>25</td>
<td>50</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>ions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphates (SO₄)</td>
<td>mg/l</td>
<td>80</td>
<td>150</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Chlorides (Cl)</td>
<td>mg/l</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>metals (dissolved)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>mg/l</td>
<td>Background</td>
<td>100</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>mg/l</td>
<td>background</td>
<td>20</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Chromium (Cr-III+VI)</td>
<td>mg/l</td>
<td>background</td>
<td>50</td>
<td>100</td>
<td>250</td>
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<tr>
<td>Lead (Pb)</td>
<td>mg/l</td>
<td>background</td>
<td>5</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>mg/l</td>
<td>background</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>mg/l</td>
<td>background</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>mg/l</td>
<td>background</td>
<td>50</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>mg/l</td>
<td>background</td>
<td>5</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Aluminium (Al)</td>
<td>mg/l</td>
<td>background</td>
<td>5</td>
<td>10</td>
<td>25</td>
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<tr>
<td><strong>biology</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Biotic index</td>
<td>4</td>
<td>&gt;3</td>
<td>3</td>
<td>&lt;3</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>

Background concentrations is a typical for natural conditions unaffected by anthropogenic activity.

### 3. Current port structure and environment conditions

#### 3.1. Current port structure

Port of Burgas is one of two most important international ports in Bulgaria located on the Black Sea coast. The port is located at the far end, in the western part of Burgas Bay, the largest bay along the Bulgarian coast line. It has been exploited since 1893. Its biggest expansions were performed in 1980 and in the period 2001-2008.
Bulgarian Ports Infrastructure Company (BPICo) is a state-owned company at the Ministry of Transport which governs the infrastructure of the public transport ports with national importance. BPICo is the owner and carries out the investment policy of Port Bourgas.

The exploitation management of the port is performed by the other state company at the Ministry of Transport - the operator “Port of Burgas” EAD.

The coordination activities related to navigation and the safety shipping in the port, the supervision and organization of the protection of the marine environment, control activities at the accepting and processing of waste, control on the observation of the technical safety of the port facilities, labor safety and of the safely conduct of cargo operations are performed by Executive Agency “Maritime Administration” (EAMA) branch Bourgas - a legal entity on the budget support to the Ministry of Transport.

Fig.3. Location of Port Bourgas terminals

Main specific of port of Bourgas, according to BG Ministry of transport, that it covers the following terminals: East terminal, Bulk cargoes terminal, Bulk terminal 2A, West terminal, Oil terminal Rossenetz and passenger terminals Nessebar and Sozopol, (Fig. 3). The oil terminal Rossenetz serves entirely the private company Lukoil Neftochim Burgas JSC.
Burgas East terminal (Fig. 4) The East Port is situated in the old eastern sea basin. General cargoes of all kinds, metals, wood, paper, foodstuff are handled in Terminal East. Also, due to operational reasons, bulk cargoes - coal, sugar, ammonium nitrate and small shipments of concentrates could be worked.

Mooring Berths 14  
Total Wharf Length 1,965 m  
Allowable Draught 10.00 m  
Open Storage 50,000 sq m  
Covered Warehouses 35,000 sq m

Fig. 4. Burgas East terminal

Bulk cargoes terminal (Fig.5). Here may be counted the old Terminal for Bulk Cargoes as well. There coals, coke, ores and ore concentrates, clinker and grain were processed using the existing covered warehouse No. 22, etc. At berth No. 20A a coastal facility is installed for handling liquid cargoes – mainly fuels, chemicals and ethanol. A pipeline connects the site with the tank farm Naftex, near Terminal West. There are also filling up station for tanker rail cars and ethanol storage tanks in the vicinity.

Mooring Berths 5  
Total Wharf Length 750 m  
Allowable Draught 11 m  
Open Storage 49,000 sq.m  
Covered Warehouses 6,000 sq.m

Fig. 5. Bulk cargoes terminal

Bulk terminal 2A (Fig.6). Here is the New Terminal 2A which has been built under the Port of Bourgas Expansion Project via JBIC loan as a first stage of the Plan for Port of Burgas development. It is intended for handling of bulk
cargoes mainly-coal, coke, ores and concentrates, clinker, etc. The facility is equipped with most sophisticated handling technology, capable of highest efficiency. It includes the following berths marked on the picture below:

![Image of Bulk terminal 2A]

Mooring Berths                                4
Total Wharf Length                              817 m
Allowable Draught                                11.50 m
Open Storage                                     108,000 sq m
Total area                                        268,000 sq m

Fig.6. Bulk terminal 2A

*Burgas West terminal* (Fig.7). Terminal West handles generally metals of all kind, RO-RO and container traffic. A modern cold storage facility is built on port's area.

![Image of Burgas West terminal]

Mooring Berths                                6
Total Wharf Length                              890 m
Allowable Draught                                11.00 m
Open Storage                                     191,000 sq m
Covered Warehouses                             24,000 sq m
Cold storage                                     7,000 sq m

Fig.7. Burgas West terminal
**Oil Terminal Rosenets Fig. (Fig.8)**

Freight handled: Refined products, Crude oil  
Mooring Berths: 3  
Total Wharf Length: 540 m  
Allowable Draught: 12.30 m  
Tonnage (dwt): 100 000 dwt  
Operating Area (Storage): 34 000 m²

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At this stage the ports in Nessebar and Sozopol are completely passenger ones and their activity is negligible and not taken into consideration in the monitoring plan.

**3.2. Environment conditions**

Current environment conditions in port Bourgas are complicated. Port activities interact with activities of adjasent industrial units in Bourgas Bay, Fig.9.
Fig. 9. Port activities interact with activities of adjacent industrial units in Bourgas Bay

It is important to consider the main inflows and sources of impact on the condition of the small Burgas Bay aquatory where the Port of Burgas and Port Rossentz are situated. It should be noted that at this stage the newly constructed sewerage systems at the Port of Burgas and those that are under construction at the moment comprise mainly polyethylene pipes with double walls that guarantee lack of leaks in environment. Waste domestic waters and first flush waters enter a pumping station and are conveyed to the city waste water treatment plant. The emergency pipes from the city sewerage discharging into Port of Burgas area that existed in the past have already been removed and the waters enter pumping stations to be transferred to the waste water treatment plant, and the constructed emergency pipes are out of Port of Burgas aquatory. The inflows marked in Fig.9 are mainly inflows from private ports and coastal inflows from coastal lakes. The treated waste waters from WWTP of Burgas city which do not always correspond to normative requirements enter with the inflow of Vaya Lake, as well as the untreated waters of Aitos town and the villages along the river valley of Aitoska River which flows into Vaya Lake. The inflow of waters from the lake is carried out
via a channel connection situated between Port West and the private port – Port Burgas. The treated waste waters of the biggest oil processing and petrochemical plant in the country – Lukoil Neftochim Burgas, enter the small Burgas Bay with the inflow of Mandra Lake, as well as the waters from the populated areas along the river valley of Sredetzka River via Sredetzka River. It could be assumed that the exchange of waters from Port of Burgas aquatory and those from the small Burgas Bay is reduced but the forthcoming measurements and numerical modeling of currents in port waters will show the actual condition.

3.3. Existing port monitoring system

The major Bulgarian ports Bourgas and Varna used in your activities Port Operational Marine Observing System (POMOS) [5]. The existing monitoring system is designed to allow real-time assessment of weather and marine conditions in the areas of bulgarian ports: Bourgas and Varna. Real-time information is obtained using various sensors. All instruments are connected to communication system via intranet which provides direct intranet access to the sensors. The measured data are transmitted to the central collecting system, where the information is processed and stored in database. Access to database is through internet/intranet with the help of browsers. Actual data can be displayed on the computer screens using report server. The system is developed in the frame of academic-government partnerships and gives up an important resource to the Bulgarian ports. The system is aligned to the needs of executive agency Maritime administration (MARAD) to Ministry of Transport for the shipping safety and traffic control in the seaports of Republic of Bulgaria, but it is available for environmental monitoring purposes and the obtained data could be used for the ECOPORT 8 project needs. The system POMOS includes three main components: measuring stations, communication system and onshore control center. A web portal operates for publishing the results of measurements in real time in different panels (Fig. 10): main panel in tabular form with last data from all measuring stations; panel of graphic controls (thermometer, potentiometers and slide controls for visualization of measured values; tabular and graphical panels, presenting the data within the last 24 hours; panel with geographical visualization of measurements. Collected data are presented in real time and information is available on-line on: http://ma.io-bas.bg

On the Port of Bourgas territory there are two existing monitoring stations, part of the Port Operational Marine Observing System (POMOS) for continuous observation of meteorological and hydro-physical parameters: wind speed, direction; air temperature, relative humidity, atmospheric pressure, visibility, water temperature, salinity and sea level. They are situated as follow: in the east part of Bulk Cargoes Terminal (BUP) and in terminal Rossenetz (BUN). Their location is shown in Fig. 3.
Fig.10. A web portal for publishing the results of measurements in real time in different panels

Coordinates of the monitoring stations are given in Table 3.

<table>
<thead>
<tr>
<th>Monitoring stations</th>
<th>Coordinates by WGS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Latitude</td>
<td>Longitude</td>
</tr>
<tr>
<td>BUP (Bulk terminal)</td>
<td>42º 29` 0.68``</td>
<td>27 28` 45.00``</td>
</tr>
<tr>
<td>BUN (Oil terminal)</td>
<td>42º 27` 13.87``</td>
<td>27 32` 8.09``</td>
</tr>
</tbody>
</table>

On the existing monitoring points at Port of Bourgas area the following measurement equipments are available:
- Weather Transmitter WXT 520 measures 6 most essential weather parameters: wind - speed, direction; liquid precipitation – rainfall, rainfall duration and intensity; air temperature; relative humidity;
- PWD 20 Visibility Sensor (Vaisala) for accurate measurement of visibility – only on Bulk Cargoes Terminal;
- S 1074 Air Thermometer (Coastal Env.);
- QMS 101 Pyranometer (Vaisala) for measuring global solar radiation;
- MicroCat SBE 37-CM (SeaBird): a high accuracy conductivity and temperature (pressure optional) recorder;
- Range Finder SM-094/10W (Miros) for measurement of ocean wave profiles and tidal variations, water level in rivers, canals, lakes etc.

Pictures of instruments installed on monitoring station BUP are shown in Fig.11.

![Fig. 11. Measurement equipments in monitoring station BUP](image)

4. Main parameters for environmental assessment in the port

4.1. Previous investigations

Up to 1988 various occasional investigations of marine water qualities in Burgas Bay were performed by different scientific institutes and research laboratories. Detailed monitoring investigations were commenced in the period 1988-1991 by the Technological Centre of Ecology and Natural Resources (TCENR), Burgas. These investigations were continued in 1992-1994 by the Institute of Fisheries and Aquaculture – Varna. Although intermittently the investigations were carried on again by TCENR in the period 1994-1997. The most complete and systematic investigations of marine water qualities in
Burgas Bay were executed in 2001-2006 and 2008 during the realization of Port of Burgas expansion project – new east breakwater, access channel and bulk cargo terminal 2A. The management of Port of Bourgas was obliged to elaborate a Plan for own monitoring for these objects. This plan was approved by Executive Environment Agency at the Ministry of Environment and Water and was executed by Lemna Ecoinvest-Bulgaria JSC as a subcontractor of the consortium Penta Ocean/Mitsubishi – Japan and Dredging International – Belgium, subsequently. The Plan for own monitoring was elaborated on the basis of Regulations No.8 and No.5 of MOEW. It included the territory of the large Burgas Bay and analyzed the condition of marine waters in the area of the depot where dredged masses were deposited and the areas around the big tourist resorts such as Sunny Beach, the towns of Nessebar, Pomorie, Burgas and Sozopol. Assessment of the impact of construction works on the qualities of marine waters in the bay was performed monthly.

As a result of these investigations and mostly during the execution of construction works related to Port of Burgas expansion 2001-2008, assessment of the condition of the main environmental parameters was performed, especially of those that are subject to Ecoport 8 project – the qualities of marine waters in the aquatory of Burgas Bay, including Port of Burgas and the qualities of atmospheric air in the Port of Burgas area.

The conclusion following these investigations of many years is that the investigated biological and physico-chemical parameters in almost all monitoring stations corresponded to the requirements of Regulations No.8 on the quality of coastal marine waters and the assessment of construction works during the execution of the Port of Burgas expansion project is that they have not exerted negative impact on the marine water parameters. Episodically there were certain deviations from the norm requirements of the regulation for some of the parameters in the monitoring point in the area of Phoros Cape which was in the immediate proximity to the performed dredging works and where the two main big inflows from the coastline get together, viz. those of Vaya and Mandra Lakes. But even here the deviations from the norm values according to Regulation No.8 for the main parameters, with the exception of transparency, were very rare.

The main sources of information in public space are from Environmental Monitoring Report chapter of the Port Burgas Expansion Project (PBEP), 2006 [6] and from Internet. Some historical data are available from the National System for Ecological Monitoring (NSEM), subsystem Waters by Ministry of Environment and Water, Bulgaria. As it is concluded in the article “Water Quality of Bourgas Port Aquatorium” [7] there is lack of measuring monitoring data about the water quality in Port Bourgas Aquatorium” in the specialized literature. There are data from monitoring points situated only outside the Port aquatorium. On the basis of available information after the analysis and interpretation of the measuring water environmental components could be concluded that during the period investigated, namely from 2001 to 2006, the
water quality status in the Bourgas bay characterized by the values of physico-chemical parameters investigated could be classified as good. All the parameters investigated meet the standard required by the Regulation No 8 on the quality of coastal marine water, [3]. But this conclusion concern only external part of port waters where are located the approach and entrance channels, roadsteads, moorage/anchorage areas. The water quality in internal harbor waters of port Bourgas is not investigated since there is lack of measuring monitoring data in the Port Authorities of Bourgas or in the specialize literature. For this reason the monitoring programme of ECOPORT 8 for port Bourgas envisage monitoring surveys in internal basins of harbor waters where ships are docking and cargo handling.

4.2. Selection of methodological coherency in monitoring

The experience gained in the recent years in the field of environmental monitoring of Port of Burgas in relation to the executed extensive construction works has shown that the most sensitive environmental parameters in terms of anthropogenic impact are marine water, air, sediments and others (noise, garbage, consumptions). These are the main groups of parameters that would show most precisely and most quickly what is the impact of port activities on the environment and what activities and measures should be implemented to eliminate negative phenomena if there are.

In order to identify the most polluted places in port waters and to reduce expenditures for expensive laboratory chemical analysis the monitoring is proposed to conduct in two stages - preliminary and full operative in internal port basins, Fig.12.

Preliminary monitoring aims to provide necessary information for common assessment of changes in natural conditions resulting from widespread anthropogenic activities in port waters and waters in small Bourgas Bay. The results from the preliminary monitoring will help to develop, to optimize and design the next stage – operative monitoring program.

The first stage includes: a) testing the waters and sediments with biological indicator; b)Numerical modeling of water circulation and currents in port waters and Bourgas Bay; c) Spectral and X-ray analysis of sediments in “hot spots”. The results from biotest and numerical modeling will provide the answer of the question where is location of of the most polluted places in port waters and who is main polluter in small Burgas bay – port or industry. The results from spectral and X-ray analysis in 5 points (in every port internal basin) will provide information which of toxic substances have to measure during the next stage in selection points in the port internal basins. In this way it would be possible to optimize and reduce the expenditures at chemical and physicochemical analysis during operative monitoring.
a) Testing with biological indicator.

Bioanalysis employs live organisms as indicators (bioindicators). A small multicellular organisms are used in microbiotests. They have following advantages [8]: relatively low cost per analysis; operating with small sample volumes; possibility of working with several samples at once; short response time; repeatability and reproducibility; tests can be used under laboratory conditions and it is possible to conduct testing in situ; no purchase of high-purity reagents and reference materials is necessary; running of biotests does not require highly qualified personnel; relatively low cost per analysis. Disadvantages are: not possible to perform qualitative and quantitative analysis for individual chemical entities that are present in the samples being analyzed and it is necessary to start testing immediately after sampling.

Data obtained from biotesting are very general, but they can be basis for answering the following question: “Is the environment toxic to live organisms and what is the rate of pollution? After comparing the results from different locations in every port basins we will focus our detail measurements in place which are the most polluted. The choice of location and number of monitoring points in ports is established following Recommendations for monitoring of physico-chemical and biological parameters of port aquatorium in General monitoring plan:

Fig. 12. Scheme of methodological consistency in port monitoring
- Close to **significant point polluting sources** (oil terminals, cargo terminals). The number of points will depend on the size of area covered by these points and their impact significance;
- Close to **significant diffuse sources** (wastewater pipes, shipyard). The number of monitoring points should reflect their impact;
- Close to areas with **significant hydro-morphological pressure** (canals, dredging sites etc).

Information about coordinates of selected monitoring points and their depth for biotest is given in Table 4.

**Table 4**

<table>
<thead>
<tr>
<th>Number of monitoring point</th>
<th>Depth (m)</th>
<th>Coordinates by WGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Latitude</td>
</tr>
<tr>
<td>1 = BUP</td>
<td>0.68'</td>
<td>42° 29` 0.68``</td>
</tr>
<tr>
<td>2 = BUN</td>
<td>13.87’</td>
<td>42° 27` 13.87''</td>
</tr>
<tr>
<td>3</td>
<td>19.31``</td>
<td>42° 29` 19.31``</td>
</tr>
<tr>
<td>4</td>
<td>15.11``</td>
<td>42° 29` 15.11``</td>
</tr>
<tr>
<td>5</td>
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</tr>
<tr>
<td>20</td>
<td>42.59``</td>
<td>42° 27` 42.59``</td>
</tr>
</tbody>
</table>
The location of selected monitoring points for biotest is presented on Fig. 13.

![Fig. 13. Location of selected monitoring points for biotest](image)

b) Numerical modeling of water circulation and currents in port waters and Bourgas Bay

From numerical modeling of water circulation and currents we expected to gain information about movement of pollution - oil spills and other dangerous liquids for the environment in Bourgas Bay and port waters. This very useful information we will compare with the results from biotests in order to identify the most polluted places in the port aquatorium. After that it will be precise the selection of monitoring points in internal port basins during operative
monitoring. For numerical modelling will be used the Marine forecasting system of National Institute of Meteorology and Hydrology - Bulgarian Academy of Sciences (NIMH-BAS), Fig.14. The operational system is fully automatic and uses state-of-art numerical models. It runs twice daily (based on 00 and 12 UTC). The system is driven by 3 hourly values of surface winds from the numerical weather prediction models ARPEGE and ALADIN.

The system produces 72 hours sea state forecasts and transmits the results to the end-users via the Internet. The system issues WARNINGS in case of storm situations in the Black Sea. The system can predict the propagation of oil spill in case of accident in the Black Sea.
Study of the effects of the potential oil spills and others dangerous liquids risk assessment for Bourgas port waters in the Bourgas Bay includes:

1. Identification of the incidents with a major risk of producing an oil pollution in Bourgas bay and port aquatorium;

2. Calculation of the trajectories of oil spills taking into account the physical and chemical properties of the product, and under different conditions - amount of oil spilled, nature of the oil, distance from the shore, wind, currents, waves;

3. Determination of locations, potentially affected by oil pollution in port waters.

The study of trajectories (oil drift) consisted of simulations a large number of scenarios that combined incident type, current field and local winds in the Bourgas bay. The oil spill model MOTHY calculates of an oil particle at the water surface as the addition of its spreading and diffusion and slick drift due to the winds, waves and currents.

The currents are, along with the winds, the main factor involved the spill trajectory. Given its importance, the numerical modeling of the hydrodynamics of the Bourgas port waters is considered necessary in order to use it for the Study of Trajectories as the next step: Numerical modeling of currents in port Bourgas using the numerical model MIKE 21 HD (from the Danish Hydraulic Institute, DHI) supporting on the field survey measurements.

c) Spectral and X-ray analysis of sediments in “hot spots”

The results from spectral and X-ray analysis in 5 points (in every port internal basin) will provide information which of toxic substances have to measure during the next stage in selection points in the port internal basins. In this way it would be possible to optimize and reduce the expenditures at chemical and physicochemical analysis during operative monitoring.

**4.3. Main parameters for environmental assessment in the port**

The environmental operative monitoring is the main part of the monitoring program. It is important for future to identify and register all kinds of environmental pollutions as a result of port works and activities and after that to plan and to apply the most effective measures and port activities against pollution. Therefore the purpose of the assigned monitoring is to collect current information about the condition of main parameters determining marine water quality, atmospheric air, sediments, garbage, noise, consumption and the possible impact which port works may have on them.

The existing normative base will be the basis of the plan for present environmental monitoring. We should mainly consider the parameters specified in
Regulation No.8 which has not been changed since that period, as well as the information and directions provided in the elaborated Plan for management of waters in the Black Sea basin region 2010 – 2015.

**4.3.1. Marine waters**

For the assessment of the ecological condition of marine waters in the Port of Burgas aquatory the requirements of Regulation No.8 on coastal marine water qualities, particularly those for sanitary protection zone are proposed. Some of the parameters can be measured automatically, in real time and submitted for the needs of navigation and ecological measures and activities by the respective exploitation management in order to deal with emergencies and accidents. According to previous experience gained during the years of marine water parameters monitoring during the realization of Port of Burgas expansion, Article 10 of Regulation No.8, the Plan for management of waters in the Black Sea basin region 2010 – 2015 and Assessment report of the possibilities for realization of environmental monitoring plan prepared by Lemna Eco Partners Ltd., we propose to control automatically once per day the following marine water parameters in the respective measurement ranges:

- Determination of pH; Measurement range: 7-10;
- Measuring temperature, in °C; Measurement range: 5-30 °C;
- Determination of dissolved oxygen (O₂), mg/l; Measurement range: 6-13 mg/l;
- Determination of turbidity, ppm; Measurement range: 0,2-20 ppm;
- Determination of specific conductivity; Measurement range: from 100 to 20 000µS/cm;
- Determination of salt content, g/l; Measurement range: 13-18 g/l;
- Determination of sea current speed and direction at the place of the sampling.

The following parameters should be measured once per week during the first three months and subsequently once per month during the following nine months on the basis of the dynamics of parameters change:

- Determination of extractable substances (oil products); Measurement range: 0,01-5 mg/l;
- Determination of chlorophyll, µg/l; Measurement range: 0,1-10 µg/l;
- Determination of biogenic elements including determination of nutrients (ammonia nitrogen, Measurement range: 0,002 – 0,2 mg/l; Nitrite nitrogen, Measurement range: 0,002 – 0,02 mg/l; Nitrate nitrogen, Measurement range: 0,02 – 0,2 mg/l; Phosphates, Measurement range: 0,005 – 0,05 mg/l);

Marine water parameters that are not possible to be monitored automatically from technical, technological and economic point of view, or their constant
measurement is not expedient should be sampled manually and analyzed in an accredited laboratory as specified in the Regulation and the plan:

- Determination of BOD$_5$; Measurement period - monthly;
- Determination of microbiological parameters (coliforms/total/, faecal coliforms, exciters of intestinal infection diseases); Measurement period - monthly; After completion of initial data base accumulation the sampling period can be changed to once per season;
- Determination of parameters for zooplankton and phytoplankton (composition, abundance and biomass). Measurement period – once per season; After completion of initial data base accumulation the sampling period can be changed to once per six months according to the requirements in Regulation No.5;

Due to the fact that practice has proven that dynamics of change of some parameters is very low, we propose to analyze them once per three months during the surveillance monitoring:

- Determination of heavy metals in waters and sediments (iron, cadmium, chromium, nickel, zinc, arsenic, lead, copper and mercury).

### 4.3.2. Air

It is recommendable to monitor the main atmospheric air parameters with automatic monitoring station equipped with gas analyzer with independently operating sensors for measuring of selecting parameters. The parameters should select depending on port activities in every terminal and according to legal regulations - the Clear Air Act (SG 45/1996, amended SG 27/2000, amended SG 102/2001), Regulation No.7 on ambient air quality assessment and management (SG 45/1999), Regulation No.9 on limit values for sulphur dioxide, nitrogen dioxide, fine particular matter and lead in ambient air (SG 46/18.05.1999).

The results from the port monitoring executed up to the moment stress the necessity to control parameters registering mainly local impact on the port territory and determination of these parameters which are related to the direction and area of a certain pollutant distribution. Therefore, at this stage it is important to control mainly the following parameters which are directly dependent on the port’s activity:

- Fine dust particles, Measurement range: 0-100 ppm;
- Wind speed at the place of sampling;
- Air temperature at the place of sampling;
- Wind direction at the place of sampling.

The rest parameters which are most often subject of air monitoring are the following:
- Nitrogen oxides, Measurement range: 0-150 ppm;
- Carbon oxides, Measurement range: 0-100 ppm;
- Hydrogen sulphide, Measurement range: 0-10 ppm;
- Sulphur oxides, Measurement range: 0-10 ppm;

According to port experience it is desirable to limit air parameters only to dust emissions. This is due to the fact that in this area of the city there is busy transport traffic but at the same time in the area of the port there is no very intensive transport traffic that could influence significantly atmospheric air parameters. Such influence can be rather exerted by loading-unloading operations and cargo storage related to bulk cargo terminal whose influence is mainly concentrated on dust emissions and it is proposed to control the parameters total suspended dust and fine dust particles.

At this stage expansion of monitoring investigations with other parameters and their inclusion in the control system is not well-grounded and, if necessary, they should be executed manually.

### 4.3.3. Sea sediments

There are still no native normative regulations for these parameters. That is why during the investigations in the recent years port contractors used the Dutch list recommended by the International Bank of Reconstruction and Development. The recommended main parameters for assessment of the ecological condition of sea sediments in the Port of Burgas aquatory are mainly based on the port experience gained in the episodic investigations during Port of Burgas expansion:

- Determination of heavy metals in sea sediments (iron, cadmium, chromium, nickel, zinc, arsenic, lead, copper and mercury). Period of measurement – once per three months. These parameters cannot be sampled and measured automatically so it is recommended to execute manual sampling and analyses in laboratory conditions by an accredited laboratory.

The proposed frequency of measurements is much higher than that envisaged in the normative documents. The purpose of this is to monitor and register changes of parameters which have greater dynamics in closed aquatories as it is in our case and which should be monitored more extensively at least during the first months of the executed surveillance monitoring and to observe what the possible changes would be in the presence of any impact.

As it was already emphasized in the present plan (in the Plan for management of waters in the Black Sea basin region) extremely important for the assessment of the aquatory condition is also biological monitoring. Phytoplankton (abundance, species composition) and zooplankton are most
accentuated in it. Very important is also the use of biological indicator species since this method makes it possible to assess aquatories similar in scope. Therefore, in addition to the executed monitoring it is necessary to carry out investigative monitoring in this direction, especially considering the fact that the project is a pilot one.

4. 3.4. Others (noise, garbage, consumptions)
a) Noise

At the assessment of this component plan has entirely complied with the requirement of Protection from Environmental Noise Act (SG 74/13.09.2005, amended SG 30/11.04.2006) and the results and obtained data and port experience from episodic measurements during construction activities related to Port of Burgas expansion and the prepared EIA Report for new container terminal at Port of Burgas.

In 2006 the Regulations to the Protection from Environmental Noise Act were issued Regulation No.6 on parameters for noise in environment showing the degree of discomfort in various parts of the day, limit values for noise parameters, methods for assessment of the values of noise parameters and harmful impacts on population’s health (SG 58/2006.)

In the Report for assessment of environment and especially noise pollution in Burgas prepared in 2007 by Regional Inspectorate of Environment and Water it is stated that at the points situated on territories impacted by intense motor traffic the measured sound pressure levels range between 63 dB/A/ and 78 dB/A/. The equivalent noise levels do not comply with the requirements of Ordinance No. 6 of the Ministry of Health with respect to noise parameters in the environment /SG, issue 58/2006/. The increased sound pressure level is mainly due to the high intensity of motor traffic (from 1115 to 3538 motor vehicles/hour), especially during rush hours and in summer, the lack of modern infrastructure to divert main transit traffic to bypass roads, lack of road facilities such as interchanges, etc., especially in the direction of large residential districts (Meden Rudnic, P.R Slaveykov and Izgrev), ageing cars and buses, narrow and not planted streets with minimum distance between buildings and road lanes, lack of enough parking places which impedes traffic in the centre of the city. All these factors serve to worsen the ambient background noise in the city which results in negative effects on population's health (disturbance in terms of neurophysiology, concentration and attention, fatigue, headache and sleep disturbance). But in the Port of Burgas where the motor traffic is low it is proposed the frequency measurements of noise level will be measured once per month in the course of 24 hours.
b) garbage,

According to Bulgarian legislation ports are required to have:

- issued permit as holders of waste;
- Waste management program based on the principles of waste hierarchy; source separation, collection and recycling of priority waste streams (Directive 2006/12/EC); waste prevention promotion (Directive 2008/98/EC);
- Waste Management Plan for ship-generated waste and cargo residues;
- Adequate reception facilities and activities to ensure the environmental and health requirements and the adoption of waste without undue delay to ships;
- Written contracts with third parties involved in waste management of ports;
- Annual report documents about the types, volumes and quantities of generated waste and adopted by ship to fill the public register of waste and the information system for wastes from ships;
- Environmental Assessment of plans and programmes setting the framework for future development of any projects in the area of waste management (e.g. National Program for Development of Public Transport Ports 2008 – 2015, Program for waste management in port as integral part of the municipal environmental programmes);
- Environmental Impact Assessment of any development proposals for installations for hazardous and non-hazardous waste neutralization and installations for household waste treatment;
- During construction activities associated with development and modernization of port infrastructure or specialization of port terminals certain measures to be taken to limit the harmful impact of waste.

During monitoring in the port of Bourgas port experts will be provide evaluation of legal regulations every month and will control the port activities connected with garbage from ships handling and all ship generated disposal, maintenance operations, emergency operations, separate waste collection, and handling of hazardous waste materials.

c) consumption

Consumption monitoring measurements will follow the requirements of General monitoring plan.
In particular, sustainable development of water resources requires the adoption of the following criteria:

- prevent the exploitation of non renewable resources (eg overexploitation of aquifers emunto when the volume exceeds the annual average power);
- directing the policy of reducing water consumption, saving water, recycling, reuse (also through tariff incentives or disincentives);
- respect the ecological balance of the system water-soil-biotic (note the quantity and quality of resources left in the water)
• reduce the generation of pollution from cities, industries and agriculture through innovative general policies;
• seek to develop not only in physical and ecological but also economic, social which will ensure the objectives of economic productivity, environmental quality, risk reduction and social equity toilets.

In the monitoring phase of water supply and sewerage we could initially introduce some meter in the input and in the output lines of users, and periodically verified the difference between input and output waters to verify possible leak in the network (if the difference overcomes the 20%).

Regarding energy (mains or others) will be sufficient to measure periodically the consumption in the port area and, basing on the analysis of data, encourage a sustainable behaviour or eventually the use of renewable or sustainable resources.

Starting from the identification of all kind of energy consumptions, past, present and future, trough the comparison and analysis of the data, we can get useful information to implement plans for improving energy efficiency, thereby reducing energy costs.

Benefits of EN 16001 Energy management are:
• Reduce costs
  Reduce energy costs via a structured approach to identifying, measuring and managing energy consumption.
• Improve business performance
  Drive greater productivity by identifying technical point solutions and affecting behavioural change to reduce energy consumption.
• Comply with legislation
  Meet current or future mandatory energy efficiency targets and/or the requirements of GHG emission reduction legislation.
• Reduce your GHG emissions
  Meet stakeholder expectations or obligations now and in the future.
• Formalise energy policy and objectives
  Create respect for the energy management policy and embed energy efficient thinking in your organization.
• Integrate management systems
  Align your EnMS with existing management systems for incremental benefit.
• Secure energy supply
  Understand energy risk exposure and identify areas of the organization at greatest risk.
• Drive innovation
  Develop opportunities for new products and services in the low-carbon economy of the future.
5. Number of monitoring points and frequency of monitoring investigation

5.1. Justification of the monitoring points and frequency in terms of perspective development and gained port experience

The selection of monitoring points follows the requirements of general monitoring plan and depending on the stage of monitoring in the port. Starting monitoring to biotest at preliminary monitoring we selected 20 points. On the ground of biotest results and results from numerical modeling we will determine locations of permanent monitoring stations. Every port terminal is specified with cargo handling and that is why in every internal basin is needed to place minimum 1 monitoring point or station.

Considering the structure of Port of Burgas aquatory at the time being and having in mind its perspective development three main areas can be differentiated: Area 1, Area 2 and Area 3.

Area 1 includes port East terminal. This area is surrounded and enclosed by the oldest quay walls of the port. The perspectives foreseen for its development include its reconstruction into yacht port and its connection with publicly accessible city territory under Super Burgas project. According to the project this part of the present territory of Port of Burgas will be turned into recreation area, attraction and yacht and cruise berths. All exploitation activity in this area should be ceased within 1-2 years. Here a station has been constructed for automatic control of the main meteorological parameters, as well as some marine water parameters such as salt content and temperature, monitoring station 1, BUP Fig. 13 and Table 4 with coordinates.

Area 2 includes all newly-constructed berths and terminals and those that are expected to be constructed. It is separated via the newly-constructed new east breakwater. Here belong Port West and the newly-constructed Bulk Cargo Terminal 2A. According to the Master Plan for Port of Burgas development here all future construction works and new terminals will be concentrated, viz. Container Terminal, Liquid Cargo Terminal, new investment intention related to Liquefied Fuel Gas Terminal. In the future all exploitation activity of Port of Burgas will be concentrated in Area 2. In this area we have 3 internal basins and the minimum of monitoring points are 3.

Area 3 includes oil port terminal Rossenets. Here a station has been constructed for automatic control of the main meteorological parameters, as well as some marine water parameters such as salt content and temperature, monitoring station 2, BUN Fig.13 and Table 4 with coordinates.

Monitoring investigations carried out up to the present moment allow for the following conclusions to be made:
1. Parameters characterizing marine water condition which were investigated every 15 days at the beginning, then monthly and then quarterly, can be divided into parameters which change dynamically and reflect seasonal changes and anthropogenic influence and parameters that remain permanently unchanged if there is absence of a source of influence. Dynamically changing parameters are the main physico-chemical parameters - pH, turbidity, dissolved oxygen, temperature, extractable substances (oil products), nutrients (ammonia nitrogen, nitrates, nitrites, phosphates), as well as biological parameters - BOD$_5$, chlorophyll and microbiological parameters. Heavy metal parameters are relatively constant in terms of time if there is no source of constant influence.

2. Parameters for assessment of atmospheric air quality are extremely dependent on exploitation activity and meteorological conditions. Therefore, when recording a measured value there should always be available information about activities carried out in the area, as well as wind speed and direction.

As a result of this investigation and generalization of the data from the port monitoring carried out in the period 2001-2008 in the aquatory of Port of Burgas, considering the investment programme of the port, the differentiation of a new exploitation territory and proceeding from potential solutions and requirements for a future monitoring plan in relation to new construction, as well as proceeding from the purposes of the present project ECOPORT 8, we propose to focus in the monitoring plan on construction of 3 automatic monitoring stations with comparatively maximum range of parameters, which will give clear and precise information about marine water quality in every cargo terminal of Port of Burgas aquatory and will serve the purposes of the project. We also propose to upgrade partially the equipment of two existing monitoring stations in area 1 and area 3 which can be equipped with a narrower range of instruments for investigation depending on type of cargo handling. Simultaneously, it is recommendable for the constructed stations to be mobile in order not to impede future construction and at the same time to serve it maximally completely.

In addition, due to the fact that the assessment of the ecological condition of marine waters in the port aquatory will be carried out on the basis of the normative values of the parameters specified in Regulation No.8, we consider and we recommend that it is necessary to equip a reference point outside port aquatory. Moreover, in the area around the aquatory of Port of Burgas there are several very big external independent sources of influence on the marine water parameters. It would be hard to affect their influence and restriction, and their assessment is subject to another much more extensive assignment. For the purposes of ECOPORT 8 it is not necessary to perform a complete assessment of Burgas Bay.
5.2. Proposed parameters in monitoring points (stations)

As it was already stated the program for detail operative monitoring investigations will be precise after preliminary monitoring. to include two points for marine waters sampling and control.

Sampling points 1 and 2 (BUN and BUP). These are the existing automatic monitoring stations at the moment where only a small number of the necessary parameters are sampled. We propose the scope of these points to be partially increased with the following parameters:

- Determination of dissolved oxygen (O₂), mg/l; Measurement range: 6-13 mg/l;
- Determination of turbidity, ppm; Measurement range: 0,2-20 ppm;
- Determination of specific conductivity; Measurement range: from 100 to 20 000µ/сm;
- Determination of chlorophyll, µg/l; Measurement range: 0,1-10 µg/l;
- Determination of sea current speed and direction at the place of the sampling.

Sampling points 3,4 and 5. These should be new sampling points with maximum scope of measured parameters, viz.:

- Determination of pH; Measurement range: 7-10;
- Measuring temperature, in °C; Measurement range: 5-30 °C;
- Determination of dissolved oxygen (O₂), mg/l; Measurement range: 6-13 mg/l;
- Determination of turbidity, ppm; Measurement range: 0,2-20 ppm;
- Determination of specific conductivity; Measurement range: from 100 to 20 000µ/сm;
- Determination of salt content, g/l; Measurement range: 13-18 g/l;
- Determination of extractable substances (oil products); Measurement range: 0,01-5 mg/l;
- Determination of chlorophyll, µg/l; Measurement range: 0,1-10 µg/l;
- Determination of nutrients (ammonia nitrogen, Measurement range: 0,002 – 0,2 mg/l; Nitrite nitrogen, Measurement range: 0,002 – 0,02 mg/l; Nitrate nitrogen, Measurement range: 0,02 – 0,2 mg/l; Phosphates, Measurement range: 0,005 – 0,05 mg/l);
- Determination of sea current speed and direction at the place of the sampling.

Their measurement frequency is specified above.

Marine water and sediment parameters that are not possible to be monitored automatically from technical, technological and economic point of view, or their constant measurement is not expedient:

- Determination of BOD₅; Measurement period - monthly;
- Determination of microbiological parameters (coliforms/total/, faecal coliforms, exciters of intestinal infection diseases); Measurement period - monthly; After completion of initial data base accumulation the sampling period can be changed to once per season;
- Determination of parameters for zooplankton and phytoplankton (composition, abundance and biomass). Measurement period – once per season; After completion of initial data base accumulation the sampling period can be changed to once per six months;

Determination of heavy metals in waters and sediments (iron, cadmium, chromium, nickel, zinc, arsenic, lead, copper and mercury). Period of measurement – once per three months

In points 1 and 2 (BUN and BUP stations) all measurements for air quality and noise should be carried out.

Yet, points 3, 4 and 5 are going to be subject of additional discussion at the time of commencement and accumulation of data base during preliminary monitoring. They are foreseen to be mobile and it makes possible for their coordinates to be changed.

We also propose to determine a reference point in an area that is remote enough from the coastal area and with negligible impact from anthropogenic pressure. We propose this to be a monitoring point which has been investigated for a long period of time and where good values of marine water parameters have been registered complying completely with the requirements of Regulation No.8, viz. point 6 from the map of the marine water monitoring in the period 2001-2007 given below Fig. 15. The point has the following coordinates:

<table>
<thead>
<tr>
<th>Coordinates measured via WGS 84</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Latitude</strong></td>
</tr>
<tr>
<td>(°'&quot;&quot;)</td>
</tr>
<tr>
<td>42°31'24.745&quot;</td>
</tr>
</tbody>
</table>
5.3. Frequency of monitoring investigations

5.3.1. Marine waters and sediments

Due to the fact that the part of parameters of the monitoring investigations are foreseen in an automatic monitoring system and it will provide information for these parameters daily, it is necessary to evaluate also the sampling frequency of parameters that will be controlled in laboratory conditions. Considering also the fact that 5 monitoring points are accessible at all time and they are not dependent on meteorological conditions, and proceeding from the importance and possibility for dynamic changes of the parameters, we propose the following frequency for parameters related to marine waters and sediments:

1. BOD$_5$ – we recommend to analyze it monthly in both points;
2. Microbiological analyzes – we recommend executing them once per season.
3. Heavy metals – we recommend to monitor them once per six months.
4. Biological parameters. Here we include Phytoplankton and Macrozoobenthos. We recommend to monitor them once per season. Regarding the reference point, we recommend to perform all measurements in it manually in an accredited laboratory once per six months.

5.3.2. Atmospheric air

We recommend to control the parameters Total suspended dust once per month in the course of 24 hours (measurement range: 0.1 – 1.0 mg/m³) and Fine dust particles once per month in the course of 24 hours (measurement range: 1- 100 μg/m³).

5.3.3. Noise

The measured noise parameters should be equivalent level Leq and maximum level Lmax. The measurements should be performed monthly in the course of 24 hours and should be within the range 40 – 100 dB(A).

The Plan for Port of Burgas monitoring includes also:

6. Specification of the measuring equipment – in the part of physico-chemical investigations this is subject of a public procurement to be announced by the beneficiary of the project – Bulgarian Ports Infrastructure Company.

7. Methods of analysis, processing and presentation of monitoring results

They will be subject of a public procurement to be announced by the beneficiary of the project – Bulgarian Ports Infrastructure Company. The Assessment report of the possibilities for realization of environmental monitoring plan provided by the Investor BPiCo includes a detailed summary of quotations related to the possibilities for implementation of an automatic system for monitoring of the main parameters listed in the Draft monitoring plan. This proves the technical feasibility of the present project.

The technical security as well as the rest parameters of the plan will not be discussed at this stage due to the fact that the present draft plan should be a starting point for elaboration of a final plan on the basis of a forthcoming public procurement for project execution and necessary equipment delivery.
9. References

[2] Regulation №5 of 23 April 2007 on water monitoring /S.G. №44/5.06.2007/;
## Appendix № 1 – Table of monitoring parameters, methods for their analysis, equipment and place of analysis execution – marine waters and sediments

<table>
<thead>
<tr>
<th>Parameter subject to monitoring investigation</th>
<th>Measurement unit</th>
<th>Limit value according to Regulation №8</th>
<th>Standard/Methods</th>
<th>Equipment used</th>
<th>Place of analysis execution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>Normal for the season</td>
<td>Instrumental method</td>
<td>Calibrated automatic thermometer; According to the quotations under the public procurement; measurement range - 5-30°C</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5-9.0</td>
<td>BSS17.1.4.27-80</td>
<td>pH-meter –Oxi WTW; According to the quotations under the public procurement; measurement range - 7-10</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>mg/dm³</td>
<td>&gt; 6.2</td>
<td>BSS EN 25814</td>
<td>According to the quotations under the public procurement; measurement range - 5-15 mg/l</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Turbidity</td>
<td></td>
<td>No</td>
<td>Test procedure</td>
<td>According to the quotations under the public procurement; measurement range - 0.2-20 ppm</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Determination of salt content</td>
<td>g/l</td>
<td>No</td>
<td></td>
<td>According to the quotations under the public procurement; measurement range - 13-18 g/l</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Determination of salt content</td>
<td>g/l</td>
<td>No</td>
<td>According to the quotations under the public procurement; measurement range - 13-18 g/l</td>
<td>Automatic monitoring system</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----</td>
<td>----</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>Determination of specific conductivity; Measurement range: from 100 to 20 000 µS/cm;</td>
<td>µS/cm</td>
<td>No</td>
<td>According to the quotations under the public procurement; measurement range - 100 - 20 000 µS/cm;</td>
<td>Automatic monitoring system</td>
<td></td>
</tr>
<tr>
<td>BOD₅</td>
<td>mg/ dm³</td>
<td>&lt; 6.00</td>
<td>BSS EN 1899-2-04 Oxi 340 I SET, WTW Germany; measurement range - 0.5-10 mgO₂/l</td>
<td>In an accredited laboratory</td>
<td></td>
</tr>
<tr>
<td>Extractable substances</td>
<td>mg/ dm³</td>
<td>&lt; 0.20</td>
<td>ILM № 10/2006</td>
<td>Automatic monitoring system</td>
<td></td>
</tr>
<tr>
<td>Nitrate Nitrogen</td>
<td>mg/ dm³</td>
<td>&lt; 1.5</td>
<td>BSS ISO 7890 – 3</td>
<td>According to the quotations under the public procurement; measurement range – 0.02-0.2 mg/dm³</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Ammonium Nitrogen</td>
<td>mg/ dm³</td>
<td>&lt; 0.1</td>
<td>BSS ISO 7150 -1</td>
<td>According to the quotations under the public procurement; measurement range – 0.002-0.2 mg/dm³</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Nitrite Nitrogen</td>
<td>mg/ dm³</td>
<td>&lt;0.03</td>
<td>BSS EN 26777</td>
<td>According to the quotations under the public procurement; measurement range – 0.002-0.02 mg/l</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Phosphates</td>
<td>mg/ dm³</td>
<td>–</td>
<td>BSS EN ISO 6878</td>
<td>According to the quotations under the public procurement; measurement range – 0.005-0.05 mg/l</td>
<td>Automatic monitoring system</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>Unit</td>
<td>Limit</td>
<td>Standard</td>
<td>Instrument</td>
<td>Laboratory</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>-------</td>
<td>----------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/dm³</td>
<td>&lt; 0.10</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/dm³</td>
<td>&lt; 0.005</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/dm³</td>
<td>&lt; 0.10</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/dm³</td>
<td>&lt; 0.05</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/dm³</td>
<td>&lt; 0.001</td>
<td>BSS 12419-82</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Arsenic</td>
<td>mg/dm³</td>
<td>&lt; 0.005</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/dm³</td>
<td>&lt; 0.01</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/dm³</td>
<td>&lt; 0.03</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab Spektral”, WTW</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/dm³</td>
<td>&lt; 0.01</td>
<td>ISO 11885</td>
<td>Spectrophotometer “Photolab”</td>
<td>In an accredited laboratory</td>
</tr>
<tr>
<td>Marine waters and sediments</td>
<td>Chlorophyll „A”</td>
<td>Spektral”, WTW</td>
<td>Automatic monitoring system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>-----------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mg/ dm³</td>
<td>5.0</td>
<td>According to the quotations under the public procurement; measurement range – 0.1-10 mg/l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coliforms (total)</td>
<td>MPN /0,1 l (most probable number in 0,1 l with classical inoculation methods)</td>
<td>10 000</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fecal coliforms</td>
<td>pc/l</td>
<td>Not allowed</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exciters of intestinal infection diseases</td>
<td>pc/l</td>
<td>Not allowed</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterococci</td>
<td>Cfu/ml</td>
<td>100/100 BSS EN ISO 7899-2</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>Cfu/ml</td>
<td>100/100 BSS EN ISO 9308-1</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>Cfu/dm³</td>
<td>0/1 Regulation 11/2002</td>
<td>In an accredited laboratory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix № 2 - Schedule of executed monitoring investigations*

<table>
<thead>
<tr>
<th>Month</th>
<th>Dates</th>
<th>Sampling Points</th>
<th>Type of monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>12-16.03</td>
<td>M.P.1,2,3,4 and 5, Reference point 6</td>
<td>All analyses in laboratory conditions – one-off measurement - marine waters and sediments</td>
</tr>
<tr>
<td></td>
<td>18-21.03</td>
<td>M. P. 1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours; one-off measurement of Fine dust particles and Total Suspended dust in the course of 24 hours</td>
</tr>
<tr>
<td>April</td>
<td>15-20.04</td>
<td>M. P. 1 and 2</td>
<td>All analyses in laboratory conditions – one-off measurement - marine waters and sediments, including phytoplankton and zoobenthos</td>
</tr>
<tr>
<td></td>
<td>20-24.04</td>
<td>M. P. 1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours; one-off measurement of Fine dust particles and Total Suspended dust in the course of 24 hours</td>
</tr>
<tr>
<td>May</td>
<td>01-30.05</td>
<td>M. P.1,2,3,4 and 5</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
</tr>
<tr>
<td></td>
<td>10-15.05</td>
<td>M. P.1,2,3,4 and 5, Reference point 6</td>
<td>Supplementary laboratory monitoring</td>
</tr>
<tr>
<td></td>
<td>15-20.05</td>
<td>M. P. 1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours</td>
</tr>
<tr>
<td>June</td>
<td>01-30.06</td>
<td>M. P. 1 and 2</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
</tr>
<tr>
<td></td>
<td>18-22.06</td>
<td>M. P. 1 and 2</td>
<td>Supplementary laboratory monitoring</td>
</tr>
<tr>
<td></td>
<td>23-26.06</td>
<td>M. P. 1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours</td>
</tr>
<tr>
<td>Month</td>
<td>Date</td>
<td>M.P. Numbers</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>July</td>
<td>01-30.07.</td>
<td>M.P.1,2,3,4 and 5</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.P.1 and 2</td>
<td>Supplementary laboratory monitoring</td>
</tr>
<tr>
<td></td>
<td>15-20.07.</td>
<td>M.P.1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours</td>
</tr>
<tr>
<td>August</td>
<td>01-30.08.</td>
<td>M.P.1,2,3,4 and 5</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including phytoplankton and zoobenthos, and Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
</tr>
<tr>
<td></td>
<td>10-15.08.</td>
<td>M.P.1,2,3,4 and 5, Reference point 6</td>
<td>Supplementary laboratory monitoring</td>
</tr>
<tr>
<td></td>
<td>23-26.06</td>
<td>M.P.1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours</td>
</tr>
<tr>
<td>September</td>
<td>01-30.09.</td>
<td>M.P.1,2,3,4 and 5</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
</tr>
<tr>
<td></td>
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<td>M.P. 1 and 2</td>
<td>One-off measurement of noise in the course of 24 hours</td>
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<td>01-30.10.</td>
<td>M.P.1,2,3,4 and 5</td>
<td>All parameters of the automatic monitoring – one-off measurement once per 24 hours, including Fine dust particles and Total suspended dust – one-off measurement in the course of 24 hours.</td>
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*Schedule of executed monitoring investigations will be revised after preliminary monitoring*