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Environmental Monitoring of the Caspian Sea

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Introduction

This book gives views on what environmental monitoring stands for, consists of and how should be organized as it is seen in Russia. The book is written on the basis of Russian official documents, discussion papers and scientific publications, which are growing in number nowadays.

All types of monitoring (environmental, economic, social etc.) are based on regular observations of something or somebody and submission of the received data to specified individuals (hereinafter named as consumers).

The designation of environmental monitoring in Russia is not limited to this function only. One of the widely spread in Russia definitions of environmental monitoring given by Yu.A. Izrael (1984) defines it as "an information system of observations, assessment and forecasting of changes in the state of environment, established to distinguish anthropogenic component of these changes against the background of natural processes". As one can see this understanding of what monitoring should include differs from that accepted in western countries. For instance, International Organization for Standardization (ISO) defines monitoring as “the programmed process of sampling, measurement and subsequent recording or signalling, or both, of various (environmental) characteristics, often with the aim of addressing conformity to specific objectives” (quoted from Chapman (1996)). Monitoring per se is envisaged to concern with the procedures and activities for collecting data and information in the formulation and implementation stages of an action or a series of initiatives. It is particularly aimed at providing regular feedback to guarantee coherence, efficiency and effectiveness against the underlying objectives set at the national and international levels. It is closely linked to environmental management; it is actually a part of the management cycle.

The rest of this introduction, and actually the whole book, are devoted to the discussion on the role and place of environmental monitoring as it is emerging now in Russia. According to the mentioned above Izrael’s definition, collection and transfer of data and information are just one of the functions of environmental monitoring, that can be called the notifying one and is to be completed with few others. One of them, the *diagnostic* function means identifying among the diversity of the surrounding world of the phenomena of certain origin and properties playing a special role in the life of nature and/or society. It is obvious that diagnostic (identifying) criteria should be determined for these phenomena first, and this is the task of scientific analysis.

As a matter of fact sometimes the diagnostic function is easily performed (e.g. the diagnostics of water bodies eutrophication), and sometimes its implementation

faces enormous difficulties, as in the instance of identifying the reason (be it natural or anthropogenic) of current climate warming on the planet.

The following function of environmental monitoring is the *environmental assessment (evaluative function)*, which is the determination of environment suitability and significance for the humanity - for both individuals and the society. Following this definition we could suppose that this assessment is of pure anthropogenic nature, but it is not so. During the past fifty years anthropocentrism has almost merged with ecocentrism. Today we can hardly find a man who would not understand that his existence is secured by the conservation of wildlife.

The significance and suitability of the environment for human beings can be reflected in the set of sanitary, economic and environmental standards (maximum permissible values of environmental parameters). They are usually referred to as environmental quality standards. Correspondingly, the assessment of environment compliance with these standards is called environmental quality assessment, while the monitoring aimed at this assessment implementation is called environmental quality monitoring. *Environmental assessment* is indeed a wider concept than e*nvironmental quality assessment,* as quality standards are set not for all the vitally important parameters.

The main tools of environment protection are the introduction of restrictions on economic or other activities and control of compliance with environmental requirements by regulated community. This control which is called *environmental control* is performed by comparing actual and permissible impact on the environment. One can form indirect judgement of the compliance with environmental requirements on the basis of observation data on the state of environment (especially in the impact zone). Consequently, environmental monitoring can perform another function, and namely the *controlling function*.

It would be perfect if environmental monitoring were of *instructive* nature and set the rules for all the participants of nature conservation activities depending on changes of environmental situation and assessment of current state and quality of the environment. The examples are few still, only two examples available in Russian experience: setting standards for atmospheric discharges depending on their dispersion conditions (an ideal example), and liquidation of emergency oil spills (a case study, though far from ideal).

The *preventive* function is closely linked with diagnostic, assessment and control functions of environmental monitoring. It is to deal with identification of natural and anthropogenic processes or their prerequisites which are hazardous for the environment. In case when only probable events are concerned environmental risk assessment is an accompanying task.

The *prognostic* function of environmental monitoring stands apart from the abovementioned functions. Its essence is expressed by its name and requires no explanation. Environmental forecasting is quite unrewarding. However complicated the forecasting models are, they can't represent (and consequently, reveal) the real world, where any trifle can be of crucial importance.

There is a reason why we have emphasized the prognostic function. It vividly illustrates another important fact: that is the determining role of monitoring function in relation to the procedure of observations, data collection and transfer. This is clearly illustrated by the example of weather service, which structure (number and location of stations, terms of observations, data transfer procedure) is completely subject to its main task - weather forecasting.

The dependence of monitoring structure on its purpose has become a key factor of formation and development of the Soviet and then the Russian system of environmental monitoring. All the people involved in this system - be it past or present - can be divided into two groups. The first group which we can call "contemplators" consider that the functions of environmental monitoring should be restricted to notification and at best to additional diagnosis and environmental assessment. The other group, "doers", suppose that the functions of environmental monitoring should include controlling, instructive and notifying functions.

The disputes between them have been going on for years, the "doers" reproach "contemplators" for uselessness and excessiveness of monitoring having no certain objectives. "Contemplators" in their turn blame their opponents for bias and narrowness of target monitoring. If only the matter were in war of words. These controversies can be traced almost everywhere - in regulatory legal acts regulating environmental monitoring, in its institutional organization and in printed papers.

Now it is time to express our point of view on this problem. In our opinion, environmental monitoring should be multifunctional. Diverse environmental monitoring will make it possible to minimize the excessiveness of "contemplative" monitoring and overcome well-known limitations of "doing" monitoring.

For a number of reasons the system of environmental monitoring accepted in Russia is mainly of "contemplative" nature. It means that the data of environmental monitoring intended for environment protection are actually not used for this purpose.

The only link connecting environmental monitoring and environmental standard setting (which is the background concentration calculated on the basis of monitoring data and used for adopting maximum permissible discharges and emissions) is about to break as a result of changes introduced into the standard setting

system. This system is based on the so called best available technologies which are not associated with the state of environment.

Small demand for environmental monitoring can't be regarded as a drawback inherent only to its status in Russia. This can be also said about environmental monitoring in the former Soviet states as it emerged in the Soviet period.

Besides environmental monitoring itself can't be blamed for it. Low demand for monitoring is more likely to result from the underdevelopment of scientific background and mechanisms of environmental management, which is a problem for many countries in the world. Consumers of environmental information in Russia and abroad still fail to make clear and unambiguous requirements to its content.

One can find our idea of the unified system of environmental standard setting, assessment and monitoring at our website http://www.caspianmonitoring.ru. Apart from that, this book is intended as a part of trilogy, which second part will be devoted to environmental assessment and the third one to environmental standard setting in Russia.

What do the mentioned above functions of monitoring have to do with the topic of the book? They help give a clearer and a more complete review of the current state of environmental monitoring of the Caspian Sea, its structure and functioning, place and role in the Russian general system of environmental monitoring, and that is the main objective of the book. Environmental monitoring is not considered as something static, it is more like a guided missile shot at a moving target. To hit the target one has to specify its coordinates and correct the trajectory of the missile.

The book consists of five chapters, which cover the procedure of environmental monitoring of the Caspian Sea at federal, regional and local levels (within Russia's borders) and at international level to which the Caspian Sea refers as it washes the coasts of the five sovereign states, as well as discusses international experience in the field of environmental monitoring. The material is presented rather in logical than in hierarchical order. The first chapter is devoted to federal, the second - to local, the third - to regional and the fifth - to international environmental monitoring of the Caspian Sea while the forth provides brief information on institutional frameworks and organization of environmental monitoring in some countries concerned with marine management. The book is not intended to make comparisons between two different approaches to monitoring, rather this short review of other countries' experience is provided to make this difference clearer to the reader. Little attention is paid to the Caspian sea itself as an object of research. This drawback is compensated for by a small geographical reference of the global dimension of the Caspian (see Annex 1).

The peculiarity of this book is that it has little direct citations of the scientific papers given in the reference list. It is explained by the fact that the book mainly analyses Russian and some other countries' regulatory and legal acts, which are referred to in the text, but not the ideas underlying those legislations, though the book reflects on and summarises some of the ideas and research papers. Results of our analysis are mainly mirrored in draft regulatory acts we offer. Therefore the text of the book partly contains comments to the documents mentioned above.

Although the author uses plural personal pronouns, he is the only one to be criticized for the information presented in the book. If anything in the book is worth praising, it is not the author's credit, but it is credited for those taking part in the organization and implementation of environmental monitoring of the Caspian Sea.

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Chapter 1. Legal background for the organization and implementation of state environmental monitoring of marine water areas

1.1. General provisions of organization and implementation of state environmental monitoring of marine water areas

The amendments to the Federal Law "On Environmental Protection" introduced by Federal Law No. 331-FZ from 21 November 2011 aimed at increasing efficiency of the state environmental monitoring came into force on 1 January 2012. These amendments will be considered in the final section of this Chapter. The other sections written mainly in August - September 2011 consider legal and regulatory background of environmental monitoring taking no account of these amendments, which are like a "face-lift" not changing the "building" itself or its "foundation" built earlier.

In accordance with the Federal Law "On Environmental Protection" environmental monitoring is an integrated system of observations of the state of the environment, and assessment and forecasting of environmental changes under the impact of natural and anthropogenic factors. In its turn, state environmental monitoring is the environmental monitoring performed by state government agencies of the Russian Federation and the RF constituent entities within their competence *(Article 1, Federal Law from 10/01/2002 No. 7-FZ (edited on 18/07/2011) «On environmental protection»).*

The organization of state environmental monitoring is completely covered in Chapter 10 Article 63 of the Law. According to it, state environmental monitoring is carried out in accordance with the legislation of the Russian Federation and the constituent entities of the Russian Federation and is aimed at observation of the state of the environment, including the state of the environment in the areas where anthropogenic impact sources are located, and the environmental impact of these sources. It is also aimed at meeting the needs of the state, legal entities and individuals for valid information required for prevention and (or) decreasing of negative consequences of environmental changes.

The procedure of organization and implementation of the state environmental monitoring (state ecological monitoring) is set by the authorized federal executive agency of the Government of the Russian Federation.

The information on the state of the environment and environmental changes

received in the course of the state environmental monitoring is used by the state governmental agencies of the Russian Federation and constituent entities of the Russian Federation and local government authorities to elaborate forecasts of social and economic development and to take relevant decisions, to elaborate federal programmes in the field of environmental development of the Russian Federation, target programmes in the field of environmental protection of the RF constituent entities and environmental protection activities. The procedure of submission of information on the state of the environment is regulated by legislation (*Federal Law from 10/01/2002 No. 7-FZ (edited on 18/07/2011) «On environmental protection»*).[1]

The Statute on organization and implementation of the state environmental monitoring (state ecological monitoring) is ratified by Resolution of the Government of Russian Federation from 31 March 2003 No. 177. According to this Statute, state environmental monitoring is an integrated system of observations of the state of the environment, assessment and forecasting of environmental changes under the impact of natural and anthropogenic factors.

Environmental monitoring comprises the monitoring of atmospheric air, land, forests, water bodies, fauna objects, unique ecosystem of Lake Baikal, continental shelf of the Russian Federation, subsoil state, exclusive economic zone of the Russian Federation, inland and territorial seas of the Russian Federation.

The organization and implementation of environmental monitoring is performed in accordance with the laws of the Russian Federation by specially authorized federal executive agencies - Ministry of Natural Resources and Environment of the Russian Federation, Federal Service for Hydrometeorology and environmental monitoring, Federal Land Cadastre Service of Russia, Ministry of Agriculture of the Russian Federation, State Committee of the Russian Federation for Fishery and other executive agencies within their competence.

Ministry of Natural Resources of the Russian Federation and other federal executive agencies, performing environmental monitoring within their competence:

form the state system of observations of the state of the environment and support the functioning of this system;

interact with state government agencies of constituent entities of the Russian Federation on the issues of organization and implementation of environmental monitoring, establishment and supporting of territorial observations systems of the state of the environment in the constituent entities of the Russian Federation;

perform, jointly with executive agencies of the constituent entities of the

[1] Main functions of the state environmental monitoring, as it follows from the Law, are notifying, diagnostic and evaluative functions. The designation and the use of the monitoring information are determined by consumers and not by suppliers of information services.

Russian Federation, the collection, storage, analytical processing and formation of state information resources on the state of the environment and the use of natural resources.

Ministry of Natural Resources of the Russian Federation:

coordinates the activities of federal executive agencies on organization and implementation of environmental monitoring;

harmonizes methodical and normative and technical documents of federal executive agencies on organization and implementation of environmental monitoring;

jointly with stakeholders among federal executive agencies and executive agencies of the RF constituent entities, ensures the compliance of information systems and databases on the state of the environment and creates conditions for forming and protection of relevant state information resources.

Environmental monitoring is carried out to:

observe the state of the environment, including that in the areas where sources of anthropogenic impact are located, and the impact of these sources on the environment;

assess and forecast changes of the state of the environment under the impact of natural and anthropogenic factors;

meet the requirements of the state, legal entities and individuals as regards to valid information needed for prevention and (or) decreasing of negative consequences of such environmental changes.

The information received in the course of environmental monitoring is used in[2]:

forecasting of social and economic development of the Russian Federation, constituent entities of the Russian Federation, municipal entities and taking relevant decisions;

elaborating of federal programmes in the field of environmental development of the Russian Federation, target programmes in the field of environmental protection of the Russian Federation, investment programmes and activities on environmental protection;

implementing control in the field of environmental protection (environmental control) and environmental assessment;

forecasting emergency situations and taking preventive measures;

[2] Note that this document stipulates for a more precise designation of information received in the course of monitoring than the Federal Law "On Environmental Protection". In particular, it states that this information is used for performing environmental control (controlling function) and preventing emergencies (preventive function). However no indication is given to the use of this information for standard setting in the field of environmental protection (instructive function).

preparation of data for the annual state report on the state of the environment and environmental protection.

Environmental monitoring solves the following tasks:

organization and implementation of observations of qualitative and quantitative parameters (their combination), characterizing the state of the environment, including that in the areas where sources of anthropogenic impact are located and the impact of these sources on the environment;

assessment of environmental conditions, timely identification and forecasting the development of negative processes producing effect on the state of the environment, elaboration of recommendations aimed at preventing harmful environmental impact;

information support of state government agencies, local government agencies, legal entities and individuals on environmental issues;

generation of state information resources on the state of the environment;

supporting the participation of the Russian Federation in international systems of environmental monitoring.

Ministry of Natural Resources of the Russian Federation and other federal executive agencies while performing environmental monitoring within their competence interact with:

the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters - within the framework of the unified state system of warning and elimination of emergencies;

the Ministry of Health of the Russian Federation within the procedure of social-hygienic monitoring;

the Russian Federal Space Agency in provision and use of methods and tools of the Earth remote sensing to support environmental monitoring (*Resolution of the RF Government from 31/03/2003 No. 177 «On organization and implementation of the state environmental monitoring»*).

Six out of ten types of environmental monitoring stipulated by the Statute are directly related to the monitoring of sea water areas, and namely: monitoring of water bodies, fauna objects, continental shelf of the Russian Federation, subsoil conditions, exclusive economic zone of the Russian Federation, inland and territorial seas of the Russian Federation. Normative and legal background for performing each of these monitoring types is covered further.

State monitoring of water bodies

In accordance with the Water Code of the RF, water body is a natural or artificial water body, watercourse or any other object, where constant or temporary

water accumulation has characteristic forms and attributes of water regime (water regime is the change of water level, discharge and volume in a water body) *(Article 1, «Water Code of the Russian Federation» from 03/06/2006 No. 74-FZ (Edited on 19/07/2011).*

According to Article 30 of the Water Code state monitoring of water bodies is a system of observations, assessment and forecasting of changes in the state of water bodies being under the ownership of the State, constituent entities of the Russian Federation, municipal establishments, legal entities and individuals. According to Articles 4 and 67 of the RF Constitution, the sovereignty of the Russian Federation covers all its territory, which comprises inland and territorial waters. Consequently, the effect of the Water Code is spread over these water areas [3].

State monitoring of water bodies which is part of the state environmental monitoring is implemented to:

1) timely identify and forecast the development of negative processes, affecting water quality in water bodies and their state, develop and take measures aimed at preventing negative consequences of these processes,

2) assess the efficiency of activities implemented to protect water bodies;

3) provide information support for management in the field of use and protection of water bodies, including state oversight of the use and protection of water bodies.

State monitoring of water bodies includes:

1) regular observations of state of water bodies, qualitative and quantitative indicators of water resources state and the usage regime of water protection zones;

2) collection, processing and storage of observation data;

3) entering the observation data into the state water register;

4) assessment and forecasting of changes in the state of water bodies and qualitative and quantitative indicators of state of water resources.

State monitoring of water bodies consists of:

1) monitoring of surface water bodies taking into account data of monitoring carried out in the course of operations in hydrometeorology and related fields;

2) monitoring of state of water bodies bottom and shores and the state of water protection zones;

3) monitoring of ground water taking into account the data of state monitoring

[3] As far as the Caspian Sea is concerned, its legal status is not determined, so the following international legal categories of marine space are not covered: inland sea water, territorial sea, continental shelf and exclusive economic zone. Until the Caspian states adopt the Convention on the legal status of the Caspian Sea, the official state border of the RF on the Caspian passes along the coastline, and the effect of the Water Code does not spread on the sea water area. Actually the Water Code of the RF applies to the water area within the Russian sector of the sea bottom and subsoil of the Caspian (see reference 8).

of subsoil conditions;

4) observations of water economic systems, including hydraulic structures and water volume in the course of water consumption and disposal.

State monitoring of water bodies is implemented within the borders of watershed districts taking into account characteristics of water bodies regimes, their physical - geographical, morphometric and other peculiarities.

The organization and implementation of environmental monitoring of water bodies is performed by governmentally authorized federal executive agencies jointly with authorized executive agencies of constituent entities of the Russian Federation.

The procedure of state monitoring of water bodies is set by the Government of the Russian Federation *(Article 30 "Water Code of the Russian Federation" from 03/06/2006 No. 74-FZ (edited on 19/07/2011).*

The statute on the implementation of the state environmental monitoring of water bodies is ratified by Resolution of the Government of Russian Federation from 10 April 2007 No. 219. This Statute sets the procedure of the state monitoring of water bodies (hereinafter referred to as monitoring) which is a system of observations, assessment and forecasting of changes in the state of water bodies being under the ownership of the State, constituent entities of the Russian Federation, municipal establishments, legal entities and individuals.

Monitoring is implemented to:

timely identify and forecast the development of negative processes, affecting water quality in water bodies and their state, develop and take measures aimed at preventing negative consequences of these processes,

assess the efficiency of activities implemented to protect water bodies;

provide information support for management in the field of use and protection of water bodies, including state oversight of the use and protection of water bodies.

Monitoring includes[4]:

regular observations of state of water bodies, qualitative and quantitative indicators of water resources state and the usage regime of water protection zones;

collection, processing and storage of observation data;

entering the observation data into the state water register;

assessment and forecasting of changes in the state of water bodies and qualitative and quantitative indicators of state of water resources.

Monitoring is part of the state environmental monitoring.

[4] State monitoring of water bodies, as it follows from the statute, is aimed at the performing of notifying, diagnostic and evaluative functions, but the information received with help of this monitoring has a wider application: it's used for control and prevention.

Monitoring consists of:

monitoring of surface water bodies taking into account data of monitoring carried out in the course of operations in hydrometeorology and related fields;

monitoring of state of water bodies bottom and shores and the state of water protection zones;

monitoring of ground water taking into account the data of state monitoring of subsoil conditions;

observations of water economic systems, including hydraulic structures and water volume in the course of water consumption and disposal.

The monitoring of water bodies is implemented within the boundaries of basin districts taking into account characteristics of water bodies regimes, their physical - geographical, morphometric and other peculiarities.

The monitoring is organized and performed by the Federal Agency of Water Resources, Federal Agency on Mineral Resources, Federal Service for Hydrometeorology and environmental monitoring jointly with authorized executive agencies of the constituent entities of the Russian Federation (hereinafter referred to as monitoring participants).

The monitoring is based on the data resulting from observations of water bodies and water utility systems, including hydraulic structures, conducted by other stakeholders among federal executive agencies with which monitoring participants cooperate (hereinafter referred to as stakeholders among federal executive agencies), and the data received through observations conducted by owners of water bodies, water consumers and subsoil users.

Monitoring is implemented on the basis of unification of software (informational and technical) resources, providing data compliance with other types of environmental monitoring.

Methodical guidelines and instructions on monitoring implementation are approved by the Ministry of Natural Resources and Environment of the Russian Federation.

Federal executive agencies and executive agencies of the constituent entities of the Russian Federation submit and exchange the monitoring data free of charge.

Forms and procedure of submission to the Federal Agency of Water Resources of the monitoring data produced by the Federal Service for Hydrometeorology and environmental monitoring, Federal Agency for Natural Resources and authorized executive agencies of the RF constituent entities (hereinafter referred to as forms and procedure of data submission), forms and procedure of submission of water bodies observations data produced by stakeholders among federal executive agencies, owners of water bodies and water bodies (hereinafter referred to as forms and

procedure of data submission), and the procedure of monitoring data exchange among monitoring participants (informational exchange procedure) are set by the Ministry of Natural Resources and Environment of the Russian Federation as agreed with monitoring participants (with the exception of authorized executive agencies of the RF constituent entities).

Federal Agency for Water Resources to organize and implement the monitoring:

ensures the development of automated monitoring information systems;

conducts regular observations of state of bottom and shores, the state and regime of the use of water protection zones and changes of morphometric characteristics of water bodies, which are fully located within the areas of certain constituent entities of the Russian Federation and which water resources are used for drinking and public water supply of two or more constituent entities of the Russian Federation; observations of state owned water economic systems, including hydraulic structures exploited by organizations under the jurisdiction of the Federal Agency for Water Resources and observations of water volume in the course of water consumption and disposal in all the water bodies.

supports the development of observation network of water economic systems exploited by organizations under the jurisdiction of the Federal Agency for Water Resources, and state of bottom and shores, water protection zones and changes of morphometric characteristics of water bodies, which are fully located within the areas of certain constituent entities of the Russian Federation and which water resources are used for drinking and public water supply of two or more constituent entities of the Russian Federation;

coordinates the monitoring of surface state-owned water bodies, the monitoring of state of bottom and shores of such water bodies, observations of water economic systems including state-owned hydraulic structures by monitoring participants and other federal executive agencies;

coordinates the records of water resources withdrawal and the discharge of sewage or drain water by owners of water bodies and water consumers as well as water quality and regular observations of water bodies and water protection zones and summarizes and assesses the results of this record-keeping and regular observations;

carries out collection, processing, storage and analysis of the observations data received by Federal Agency for Water Resources and the subordinate organizations and any other monitoring participants and the data submitted by stakeholders among federal executive agencies, owners of water bodies and water consumers;

conducts general assessment and forecasting of changes in state of water

bodies, their shores and bottom, their morphometric characteristics, water protection zones, qualitative and quantitative indicators of water resources state and the state of water economic systems, including hydraulic structures;

forms monitoring data bank on watershed districts, river basins, water economic sites, territories of the constituent entities of the Russian Federation and the Russian Federation as a whole;

provides entering of the observation data received in the course of monitoring into the state water register;

ensures the submission of the monitoring data to federal executive agencies, government agencies of constituent entities of the Russian Federation, local government agencies, legal entities and individuals in accordance with the water legislation and the Federal Law "On information, information technologies and information protection".

Federal Service for Hydrometeorology and environmental monitoring in the course of the monitoring of the surface water bodies:

conducts regular observations of conditions of the surface water bodies in respect of qualitative and quantitative indicators of state of water resources, inland sea waters and territorial sea of the Russian Federation, continental shelf and the exclusive economic zone of the Russian Federation on the basis of the state observation network;

conducts assessment and forecasting of changes in the state of surface water bodies in respect of qualitative and quantitative indicators of state of water resources.

provides the collection, processing, summarizing and storage of data received as a result of observations of water bodies, and the submission to the Federal Agency for Water Resources of the data of the surface water monitoring implemented in the course of activities in hydrometeorology and the related fields in accordance with the accepted forms and procedure of data submission and the procedure of information exchange;

provides the submission of the monitoring data of the surface water bodies to federal executive agencies, government agencies of constituent entities of the Russian Federation, local government agencies, legal entities and individuals in accordance with the procedure set by the Federal Law "On information, information technologies and information protection".

Federal Agency on Mineral Resources, in the course of ground water monitoring:

supports the development of an observation network designed in particular to carry out ground water monitoring with account to state monitoring of subsoil state;

organizes regular observations of the state of underground water bodies,

including observations of ground water quality for physical, chemical, radiation and microbiological parameters, coordinates observations of subsoil state connected with the use of ground water by subsoil users;

carries out collection, processing, summarizing and storage of observations data, summarizes the data received as a result of observations by subsoil users, assesses and forecasts changes of state of underground water bodies;

submits the data of subsoil water monitoring to the Federal Agency for Water Resources in accordance with the accepted forms and procedure of data submission and information exchange;

ensures the submission of the ground water monitoring data to federal executive agencies, government agencies of constituent entities of the Russian Federation, local government agencies, legal entities and individuals in accordance with the procedure set by the Federal Law "On information, information technologies and information protection".

Executive agencies of the constituent entities of the Russian Federation taking part in the organization and implementation of monitoring:

organize regular observations of state of bottom and shores, the state and regime of the use of water protection zones and changes of morphometric characteristics of water bodies or their sectors being under state ownership and located within the areas of a constituent entity of the Russian Federation, with the exception of water bodies which are monitored by federal executive agencies and water bodies and water economic systems, including hydraulic structures, located within the area of a constituent entity of the Russian Federation and being under the ownership of a constituent entity of the Russian Federation as well as municipal establishments;

carry out the collection, processing, summarizing and storage of observations data of state of bottom and shores, water protection zones or their sectors being under state ownership and observations of water bodies and hydraulic structures under the ownership of constituent entities of the Russian Federation, submit them to territorial agencies of the Federal Agency for Water Resources in accordance with the accepted forms and procedure of data submission and information exchange and submit the data on violations of usage of water protection zones received as a result of the regional state control and surveillance over the use and protection of water bodies.

Federal executive agencies supervising organizations running the state-owned hydraulic structures:

carry out observations of the relevant water economic systems, including hydraulic structures;

carry out the collection, processing, summarizing and storage of data received

as a result of these observations and submit them to the Federal Agency for Water Resources in accordance with the accepted forms and procedure of data submission and information exchange;

ensure the submission of the observations data on water economic systems including hydraulic structures to federal executive agencies, government agencies of constituent entities of the Russian Federation, local government agencies, legal entities and individuals in accordance with the procedure set by the Federal Law "On information, information technologies and information protection".

Owners of water bodies and water consumers in accordance with the procedure set by the Ministry of Natural Resources and Environment of the Russian Federation:

record water resources withdrawal from water bodies and the discharge of sewage or drain water and its quality;

conduct regular observations of water bodies (their morphometric characteristics) and water protection zones;

submit to the territorial agencies of the Federal Agency for Water Resources the data received as a result of these records and observations in accordance with the accepted form and periodicity;

Federal Agency for Water Resources, Federal Agency on Mineral Resources, and Federal Service for Hydrometeorology and environmental monitoring interact in the course of monitoring activity with the following stakeholders among federal executive agencies:

with the Federal Service for the Oversight of Natural Resources in respect of use of the data received in the course of state control in the field of environmental protection (federal state environmental control), including control and oversight of the use and protection of water bodies (federal state control and oversight of the use and protection of water bodies);

with the Federal Service for Environmental, Technological, and Nuclear Supervision in respect of use of the data received in the course of state control and oversight of safety of the hydraulic structures under supervision;

with the Federal Service for the Oversight of Consumer Protection and Welfare in respect of the data received in the course of social and hygienic monitoring, the data on assessment of water quality in drinking and public water supply systems and on assessment of conditions of water bodies used for recreational purposes and containing natural curative resources;

with the Federal Agency for Fishery in respect of use of the data received in the course of monitoring of water biological resources, i.e. the assessment of water bodies conditions as a habitat of water biological resources;

with the Federal Service for the Oversight of Transport in respect of use of the

data received in the course of control and oversight of the sea (including sea trade, specialized and fish ports with the exception of ports of fishing collective farms) and inland water transport..

Stakeholders among federal executive agencies ensure the collection, processing, storage and orderly submission of the data specified in this item and required for monitoring implementation to the Federal Agency for Water Resources (*Resolution of the RF Government from 10/04/2007 No. 219 (edited on 13/07/2011) "On adoption of the Statute on implementation of the state monitoring of water bodies*").

State monitoring of fauna objects

In accordance with the Federal Law "On Fauna" state monitoring of fauna objects is a system of regular observations of distribution, number, physical conditions of fauna objects, and the structure, quality and area of their habitat.

State monitoring of fauna objects is held to timely identify the parameters mentioned in the previous paragraph, assess these changes, prevent and eliminate the consequences of negative processes and phenomena to preserve biological diversity, support sustainable status of fauna objects and their use supported by research [5].

The procedure of implementation of fauna objects monitoring is set by the federal executive agency authorized by the Government of the Russian Federation (*Article 15, Federal Law from 24/04/1995 No. 52-FZ (edited on 18/07/2011) "On Fauna"*).

The Statute on the procedure of state recording, state cadastre and state monitoring of fauna objects is ratified by the Resolution of the Government of the Russian Federation from 10 November 1996 No. 1342. In accordance with the specified procedure, state recording of fauna objects (further recording), state cadastre of fauna objects (further cadastre) and state monitoring of fauna objects (further monitoring) on a permanent or temporary basis occurring on the territory of the Russian Federation, within continental shelf and exclusive economic zone of the Russian Federation are implemented in accordance with the unified regulations adopted by the State Committee of the Russian Federation for Environmental Protection jointly with the Ministry of Natural Resources of the Russian Federation, using unified formats of information storage and observing the principles of compliance and compatibility with state cadastres of natural resources.

[5] The structure of tasks of environmental monitoring in general is well traced by the example of fauna objects monitoring (including monitoring of hunting and aquatic biological resources). The tasks can be classified by organization of observations (1), information preparation (2) and further use (3). Clear statements of information designation ensure well-organized systems of observations and data processing, while vague statements disorganize these systems.

State Committee of the Russian Federation for Environmental Protection ensures intersectoral coordination on the issues of recording, cadastre and monitoring.

The following institutions are responsible for the organization and keeping of records, cadastre and monitoring:

Ministry of Agriculture of the Russian Federation is responsible for game fauna objects and fauna objects entered in the special list of pests of domestic animals and pest of plants (with the exception of forest pests);

State Committee for Fishery of the Russian Federation is responsible for fauna objects which refer to fishery objects.

State Committee of the Russian Federation for Environmental Protection is responsible for fauna objects which do not belong to game or fishery categories, and fauna objects included in the Red Book of the Russian Federation and Red Books of the constituent entities of the Russian Federation;

Federal Agency for Forestry of the Russian Federation is responsible for fauna objects which belong to the special list of forest pests;

Ministry of Healthcare of the Russian Federation is responsible for fauna objects which belong to the special list of animal species posing a threat to human health;

The abovementioned executive agencies carry out recording, cadastre and monitoring within their competence jointly with executive agencies of the constituent entities of the Russian Federation (within their territories) and the Russian Academy of Science (if special scientific research is required).

Users of fauna objects are to keep records of the objects use and the scope of their withdrawal and annually submit the received data to the federal executive agencies responsible for the organization and recording of relevant fauna objects in accordance with the procedure set by recording rules and regulations.

State Committee of the Russian Federation for Environmental Protection, Ministry of Agriculture of the Russian Federation, State Committee for Fishery of the Russian Federation, Federal Agency for Forestry of the Russian Federation and Ministry of Healthcare of the Russian Federation summarize the recording and cadastre data on relevant fauna objects for constituent entities of the Russian Federation and for the country as a whole, analyse these data and organize periodical publications of recording and cadastre materials.

State Committee of the Russian Federation for Environmental Protection summarizes the recording and cadastre data on fauna and includes the summarized data and the analysis results into the annual state report on the state of the natural environment in the Russian Federation (*Resolution of the RF Government from*

10/11/1996 No. 1342 "On procedure of state recording, state cadastre and state monitoring of fauna objects").

One of the types of state monitoring of fauna objects is the **state monitoring of game resources and their habitat**[6]. In accordance with the Federal Law "On hunting and conservation of game resources", state monitoring of game resources and their habitat is a system of regular observations of:

1) number and distribution of game resources, their location in the habitat, state of game resources and change dynamics for different species;

2) state of habitat of game resources and hunting grounds.

State monitoring of game resources and their habitat is part of state environmental monitoring.

Data of the state monitoring of game resources and their habitat are used for the organization of efficient use of game resources, conservation of game resources and their habitat.

State monitoring of game resources and their habitat is carried out by government authorities intra vires.

The executive agencies of constituent entities of the Russian Federation carrying out state monitoring of game resources and their habitat within the area of the constituent entity of the Russian Federation submit the data of the state monitoring of game resources and their habitat to the authorized federal executive agency.

The procedure of the state monitoring of game resources and their habitat and its data application is adopted by the authorized federal executive agency (*Article 16 of the Federal Law from 24/07/2009 No. 209-FZ (edited on18/07/2011) "On hunting and conservation of game resources and introduction of changes into certain legislative acts of the Russian Federation»).*

The procedure of implementation of the state monitoring of game resources and their habitat and its data application was adopted by Order of the RF Ministry of Nature from 06 September 2010 No. 344. In accordance with this procedure the state monitoring of game resources and their habitat (hereinafter referred to as state monitoring) is a system of regular observations of the number and distribution of game resources, their location in the habitat, state of game resources and changes dynamics for different species, state of game resources habitat and hunting grounds.

The state monitoring data consist of the annually updated data on the number and distribution of game resources, their location in the habitat, state of game

[6] Hunting is banned in the open Caspian Sea, but is allowed on the coasts (with the exception of protected areas) and the river estuaries. The borders of hunting farms located near the sea edge of the delta partly cover the shallow zone of the North Caspian.

resources and changes dynamics for different species, state of game resources habitat.

The state monitoring data are applied to organize the efficient use of game resources, conservation of game resources and their habitat.

The following issues are determined within state monitoring:

the number and distribution of game resources (by species), their location in the habitat (within hunting grounds or other areas which are a habitat for game resources);

dynamics of changes in the number of game resources for different species since the launch of the state monitoring in the constituent entity of the Russian Federation;

state of game resources (fertility, diseases of game resources);

state of game resources habitat;

the area of hunting grounds (public and privately owned) or other territories which are a habitat of game resources (further referred to as other territories);

area of sites fit for game resources habitation.

State monitoring within the area of the constituent entity of the Russian Federation with the exception of protected areas of federal importance is performed by the executive agency of the RF constituent entity authorized in the field of hunting and conservation of game resources (further referred to as the authorized agency).

State monitoring in the protected areas of federal importance is performed by nature conservation institutions determined by the law on protected areas (hereinafter referred to as nature conservation institutions).

The state monitoring:

assesses the areas of the following habitat categories, making up the area of the constituent entity of the Russian Federation:

forests (areas covered by tree and shrub vegetation for more than 20% of the area, the height of vegetation exceeding 5 m);

young growth and shrubs (areas covered by tree and shrub vegetation for more than 20% of the area, the height of vegetation not exceeding 5 m);

tundras (treeless areas of sub-polar regions located beyond the boundaries of polar vegetation, and the areas with permanently frozen soil which are not flooded by sea or river water);

swamps (areas exceedingly saturated by water constantly or for most part of the year and covered by specific hygrophyte vegetation);

meadow-steppe complexes (areas covered by perennial mesophytic and xerophytic grassland vegetation);

Alpine meadows (areas covered by highland grassland vegetation located above mountain forests);

deserts and rocks (which area is covered by vegetation for less than 20%); This category also includes saline land, glaciers, rocks and rocky land without any vegetation).

agricultural land (areas involved in agricultural activities, pastures (including flooded ones), fallow land and hayfields);

inland water bodies (all areas of watercourses (rivers, streams, reclamation channels), lakes, ponds and water reservoirs);

floodplain complexes (areas flooded during flood periods, located between the average minimum and maximum water edges, including those covered by tree and shrub vegetation);

waterside complexes (periodically flooded coastal areas (including tidal ones) of lakes, ponds, water reservoirs, seas or their parts and other water bodies located between the average minimum and maximum water edges, as well as shallow parts of these water bodies covered by above-water hygrophyte vegetation);

transformed or damaged sites (forests damaged by fires (burnt-out forests), areas of windfalls, peat fields, sites with soil cover disturbed by production of mineral resources and other anthropogenic impacts);

sites which are not fit for hunting (areas occupied by populated centres, industrial complexes, ruderal areas (dumps, cemeteries etc.));

collects data on the number and state of game resources:

within public hunting grounds and in other areas which are a habitat for game resources - by authorized agencies;

within privately owned hunting grounds - by legal entities and individual entrepreneurs which have hunting agreements or the right of long-term use of the fauna, which emerged on the basis of long-term licences for fauna use in respect of game resources;

within protected areas of federal importance - by nature conservation agencies.

State monitoring is carried out for all the species of game resources occurring within the area of a constituent entity of the Russian Federation.

The authorized agency annually submits the state monitoring data to the Ministry of Natural Resources and Environment of the Russian Federation before May 15.

Data of the state monitoring of game resources and their habitat are submitted and stored in hard and soft copies.

Ministry of Natural Resources and Environment of the Russian Federation summarizes the state monitoring data submitted by the authorized agencies.

The state monitoring data are used to form state information resources on the state of game resources, their habitat and hunting grounds and to implement state

environmental monitoring (*Order of RF Ministry of Natural Resources from 06/09/2010 No.344 "On adoption of the Procedure of the state monitoring of game resources and their habitat and application of its data"*).

One of the types of state monitoring of fauna objects is the **state monitoring of water biological resources**. In accordance with the Federal Law "On fishery and conservation of water biological resources", state monitoring of water bioresources and their habitat is a system of regular observations of:

1) distribution, number, quality and reproduction of water bioresources and their habitat;

2) fishing and conservation of water biological resources.

State monitoring of water biological resources is part of state environmental monitoring.

Data of the state monitoring of water bioresources are used to organize efficient use and conservation of water bioresources and to settle the arguments in the field of fishing and conservation of water biological resources, as well as to make liable individuals who have broken the law on fishing and conservation of water bioresources.

State monitoring of water biological resources is carried out the federal executive agency in the field of fishery.

The procedure of implementing of the state monitoring of water biological resources is ratified by the Government of the Russian Federation (*Article 42, Federal Law from 20/12/2004 No. 166-FZ (edited on 18/07/2011) "On fishery and conservation of water biological resources"*).

The statute on implementation of the state monitoring of water biological resources is ratified by Decree of the Government of Russian Federation from 24 December 2008 No. 994. This statute sets the procedure of state monitoring of water biological resources (further referred to as monitoring and water bioresources respectively), and its data application.

Monitoring is the system of regular observations of:

a) distribution, number, quality and reproduction of water bioresources which refer to fishery objects and their habitat;

b) fishing and conservation of water biological resources.

Monitoring is carried out to apply its data for:

a) annual assessment and forecasting of changes of biological status, number, distribution and reproduction of water biological resources and their habitat under the impact of natural and anthropogenic factors;

b) entering of the monitoring information into the state fishery register;

c) preparation of annual information to be included in state reports on the state

of the environment;

d) timely identification and forecasting of processes which affect the state of water biological resources and their habitat;

e) organization of efficient use of water bioresources, including the elaboration and orderly introduction of fishing restrictions;

f) elaboration of activities on conservation of water bioresources and their habitat and their introduction into fishing rules;

g) assessment of efficiency of the implemented activities to conserve water bioresources and their habitat;

h) state control in the field of water bioresources protection and control of location and activities of vessels implementing production (catch) of water bioresources, acceptance, processing, transshipment, transportation and storage of catches, port unshipping, provision of vessels and facilities with fuel, water, food, containers and other materials and observation of fishing rules;

i) meeting the needs of the state, legal entities and individuals for valid information on the state of water bioresources and their habitat, including settlement of arguments in the field of fishery and water bioresources protection and making liable the people who have broken the law on fishing and conservation of natural resources.

Monitoring is part of the state environmental monitoring.

Observations of distribution, number, quality and reproduction of water bioresources which refer to fishery objects and their habitat include:

a) collection of information and study of distribution, number and reproduction of water bioresources which are fauna objects and fishing targets and their habitat, carried out on the basis of annual plans of resource research and monitoring;

b) collection of information on the quality of water biological resources and their treatment products on the basis of the law of the Russian Federation.

The observations of fishery and water bioresources protection include the control of vessels carrying out fishing and getting the materials for the analysis of fishing parameters which involves collection, processing and storage of information on fishing data determined by the Federal Agency for Fishery, on the location of vessels implementing marine resource studies and production (catch) of water bioresources, acceptance, processing, transshipment, transportation and storage of catches, unshipping in ports, providing vessels and facilities with fuel, water, food, containers and other materials and on water bioresources, their products located on the vessels and data on their transportation, transshipment and unshipping in respect of:

a) Russian and foreign vessels - in the inland sea water of the Russian

Federation, in the continental shelf of the Russian Federation, in the exclusive economic zone of the Russian Federation, in the Caspian and the Azov seas;

b) Russian vessels under the national flag of the Russian Federation and registered in the ports of the Russian Federation - in the areas of effect of international treaties of the Russian Federation in the field of fishery and water bioresources conservation and in the open water space.

To perform the control, Russian and foreign vessels listed in items "a" and "b" should be equipped with technical control tools, providing continuous automatic transmission of the information mentioned above.

The vessels are equipped with technical control tools at the expense of their owners.

The monitoring is organized and implemented by the Federal Agency for Fishery, its subordinate research organizations and federal state institutions - basin departments for conservation and reproduction of water bioresources and organization of fishing and by federal state institution "Centre of fishery monitoring system and communication" and its branches.

The monitoring can make use of the observations data on the state of water bioresources and their habitat, presented by other federal executive agencies and executive agencies of the constituent entities of the Russian Federation as well as by individuals and legal entities carrying out fishing for research and control purposes in accordance with the established procedure.

The monitoring is performed on the basis of unification of software (informational and technical) tools and observations data, providing the compliance of its data with other types of environmental monitoring.

The governmental agencies of the Russian Federation receive the monitoring data upon their request and exchange these data on a free-of-charge basis.

To carry out monitoring and use of the received data, Federal Agency for Fishery :

a) supports the operations of the sectoral monitoring system,

b) annually elaborates and adopts the plans of resource research and state monitoring within the terms set by the Resolution of the Government of the Russian Federation from 15 October 2008 No.765 "On the procedure of preparation and decision - taking on assigning water biological resources suitable for fishing to private use";

c) elaborates and adopts methodical documents on monitoring organization;

d) adopts forms of documented information submitted to the Federal Agency for Fishery by subordinate organizations to form state fishery register;

e) submits data of water bioresources monitoring for state reports and official

publications;

f) carries out information exchange at interagency and international levels in accordance with the accepted procedure;

g) forwards the data on inclusion of species into the Red Book of the Russian Federation to the Federal Service for the Oversight of Natural Resources in case it receives data on the critical state of the stock;

h) immediately after receipt, submits to the Federal Security Service of the Russian Federation the monitoring data on the location of vessels carrying out fishing (catch) of water bioresources, acceptance, processing, transshipment, transportation and storage of catches, unshipping in ports, providing vessels and facilities with fuel, water, food, containers and other materials and on water bioresources, their products located on the vessels and data on their transportation, transshipment and unshipping in ports;

i) upon the request of the organizations included in the state fishery register, judicial and law-enforcement agencies of the Russian Federation provides the monitoring data on commercial activities of vessels, quality of catches, water bioresources products and managing commercial fishing, including data of the sectoral monitoring system on the location of Russian and foreign vessels to resolve arguments in the field of fishing and conservation of water bioresources.

The research organizations and federal state institutions - basin departments for conservation and reproduction of water bioresources and organization of fishing [7]subordinate to the Federal Agency for Fishery carry out:

a) observations of distribution, number, quality and reproduction of water bioresources and their habitat;

b) research envisaged by the annual plans of resource research and state monitoring, collection of information on the state of water bioresources and their habitat;

c) collection of information on quality of biological resources and their products within the terms set by the Federal Agency for Fishery for fishery basins;

d) processing and summarizing of information on the state of water bioresources and their habitat received in the previous year annually before March 15;

e) accumulation and storage of information received as a result of observations of distribution, number, quality and reproduction of water bioresources which refer to fishery objects and their habitat as well as the quality of water bioresources and their

[7] These organizations in the Caspian Sea include Caspian Research Institute for Fisheries (FSUE "KaspNIRKh"), North-Caspian and West-Caspian basin departments for fishery and conservation of water biological resources (FSUE "Sevkasprybvod" and "Zapkasprybvod" respectively).

products in relevant fishery basins;

f) submission of the monitoring data to the Federal Agency for Fishery and its territorial agencies in accordance with the instruction adopted by the Agency endorsed with the Federal Security Service of the Russian Federation.

Federal State Institution "Centre of fishery monitoring system and communication" and its branches carry out:

a) observation of fishing and conservation of water biological resources;

b) collection, processing and storage of information and submission of automatically transmitted data on the location of Russian and foreign vessels carrying out fishing and resource research and equipped with technical control tools;

c) to support state fishery register, collection, processing, storage and submission of data on production activities of vessels which come as daily reports of ship captains, certified by electronic digital signature in accordance with the procedure accepted by the legislation of the Russian Federation;

d) collection, processing, storage and submission of data on production activities of fishery organizations which come as operating report by managers of these organizations before the 15th and the last day of every month and as quarterly statistical reports of the organizations;

e) submission of monitoring data to the Federal Agency for Fishery and its territorial agencies in accordance with the instruction adopted by the Agency and endorsed with the Federal Security Service of the Russian Federation;

f) provision of informational interaction between the Federal Agency for Fishery and federal executive agencies in accordance with the Statute and the concluded agreements;

g) real-time submission to the Federal Agency for Fishery and agencies of the Federal Security Service of the Russian Federation of the data on detected corruption of data on the location of Russian and foreign vessels in the inland sea waters of the Russian Federation, territorial sea of the Russian Federation, exclusive economic zone of the Russian Federation and on continental shelf of the Russian Federation, and other signs of violations of the RF laws on fishery and conservation of water bioresources *(*Resolution of the RF Government from 24/12/2008 No. 994 "On adoption of Statute on implementing of the state monitoring of water biological resources and its data application"*)*.

State monitoring of the state of subsoil

In accordance with the Statute on the procedure of state monitoring of subsoil state, ratified by Order of the MNR of Russia from 21/05/2001 No. 433, state monitoring of subsoil (geological environment) state (hereinafter referred to as SMSS) is a system of regular observations, collection, accumulation, processing and analysis of information, assessment of the state of geological environment and forecasting of its changes under the impact of natural factors, subsoil use and other types of economic activities[8]. SMSS is part (subsystem) of the integrated system of environmental monitoring[9].

The objective of SMSS is the information support of management of the state subsoil fund and the efficient subsoil use in respect of SMSS tasks and objectives.

Main tasks of the SMSS are as follows:

- receipt, processing and analysis of data on subsoil state;

-assessment of subsoil state and forecasting of its changes;

- timely identification and forecasting of natural and anthropogenic processes affecting the subsoil state;

- recording of subsoil state at subsoil use objects, ground water resources and their movement;

- development, ensuring implementation and efficiency analysis of measures on securing environmentally safe subsoil use and subsoil protection and on preventing or reducing of negative impacts of geological hazards;

-regular information support of state agencies, organizations, subsoil users and other resource users on changes in subsoil state in accordance with the established procedure;

- interagency and international cooperation in the field of environmentally-friendly nature management.

The system of state monitoring of subsoil state includes the following subsystems:

-monitoring of ground water;

- monitoring of hazardous exogenous geological processes;

- monitoring of hazardous endogenous geological processes;

[8] In accordance with the agreements concluded between the Russian Federation and the Republic of Kazakhstan and the Republic of Azerbaijan from 1998 to 2002, there emerged the Russian sector of the bottom and subsoil, which borders are clearly marked by marking lines. We offer to call the Russian sector of subsoil use the sea area and air space above it limited by the border line of the Russian Federation at land site and by international demarcation lines of the sea bottom at sea. The Russian sector of subsoil use includes water area sites crossed by demarcation lines; within these lines and in accordance with international treaties subsoil is used in accordance with the laws of the Russian Federation.

[9] In its description, SMSS is more similar to basic state environmental monitoring.

- monitoring of hydrocarbons deposits;

- monitoring of solid minerals deposits;

- monitoring of subsoil sites used for other purposes than mineral resources extraction;

- monitoring of subsoil sites affected by economic activities not connected with subsoil use;

- monitoring of geological environment of continental shelf.

a) The subsystem of ground water monitoring (monitoring of ground water bodies) is aimed at assessing the state of ground water and forecasting the changes of its state, including the exploited deposits of ground water, recording of useful ground water storage and use, registering of the state water cadastre in the section "ground water". Monitoring of ground water is at the same time a part of state monitoring of water bodies. The results of water bodies monitoring are accounted for in the SMSS system if necessary.

b) The subsystem of monitoring of hazardous exogenous geological processes is aimed at identification, registration, assessment and forecasting of hazardous exogenous geological processes and is functionally connected with the Russian automated information management system for emergency situations.

c) The subsystem of hazardous endogenous geological processes is aimed at real-time control of the changes in deflected mode of rocks in seismically active areas to forecast severe earthquakes. The subsystem is at the same time part of the federal system of seismic observations and forecasting of earthquakes.

d) The subsystem of hydrocarbon deposits monitoring is aimed at the assessment of current state of the developed oil and gas blocks and forecasting of changes in this state, including pollution of subsoil with oil products, accounting of subsoil state for subsoil use sites connected with production of hydrocarbons.

e) The subsystem of monitoring of solid mineral deposits is aimed at the assessment of current state of the developed deposits and forecasting of changes in this state, including observations of rock massif and deformation of the Earth surface in accordance with the requirements of Federal Committee for Mining and Industrial Supervision of Russia, accounting of subsoil state for subsoil use sites connected with production of solid minerals.

f) The subsystem of monitoring of subsoil sites used for purposes other than mineral resources extraction is aimed at the assessment of subsoil state and forecasting of its changes in the course of construction and exploitation of underground structures, the construction and exploitation of oil and gas reservoirs in the rock strata, in the course of burials of radioactive or other dangerous waste in the deep underground horizons and burial of industrial or domestic wastes in the subsoil.

g) The subsystem of monitoring of subsoil sites affected by economic activities not connected with subsoil use is aimed at the assessment of subsoil state and forecasting of its changes, including subsoil pollution, activation of exogenous and endogenous processes under the impact of different economic facilities.

h) The subsystem of monitoring of geological environment of continental shelf. is aimed at the assessment of changes in composition and properties of bottom sediments, the state of ground water and development of exogenous geological processes within the shelf, and the effect of development of mineral resources in the shelf on other components of the environment (sea water, biota, etc.).

5. The activities on the state monitoring of subsoil state are implemented by the Ministry of Natural Resources of the Russian Federation (MNR of Russia) jointly with other authorized state agencies in the field of environmental protection and nature management.

In connection to SMSS, the Ministry of Natural Resources of the Russian Federation within its competence interacts with:

- the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters - coordination of activities in case of emergency situations (natural catastrophes, hazardous geological processes);

- the Ministry of Healthcare of the Russian Federation - in implementing of the social-hygienic monitoring in respect of the assessment of water quality of ground household water supply and the state of mineral water referring to natural curative resources;

- with the Federal Land Cadastre Service of Russia - on the issues of state monitoring of lands, state land cadastre and land management in respect of data on borders and areas of land sites, their legal status, conditions and use;

- with the Federal Service for Hydrometeorology and environmental monitoring of Russia - in monitoring of the surface water, marine environment, atmosphere and soils concerning the impact assessment of changes in these environmental components state on the subsoil state;

- with the Federal Mining and Industrial Inspectorate of Russia - in the monitoring of deposits of hydrocarbons, mineral, heat power and industrial ground water, solid minerals and subsoil sites used for the purposes other than mineral resources production;

-with Federal Inspectorate of Russia for Nuclear and Radiation Safety - in monitoring of subsoil sites allotted for burial of radioactive wastes.

Regulatory, methodical and organizational support of SMSS is carried out by the MNR of Russia.

State monitoring of subsoil state is implemented at federal, regional, territorial

(administrative) and target (local) levels [10].

a) The procedure of organizational and financial support of SMSS activities at federal and regional levels is determined by the MNR of Russia.

b) SMSS at the territorial (administrative) level is ensured by territorial agencies of the MNR of Russia jointly with authorized agencies for environment protection and nature management of the constituent entities of the Russian Federation.

c) Target (local) monitoring of subsoil state is ensured by subsoil users or other resource users, producing an effect on subsoil state. Conditions, scope and types of monitoring are determined in the process of allotting of sites for subsoil use.

The information basis for SMSS implementation is formed by the data on the state of subsoil received through operations related to geology prospecting, mining and other activities connected with the state geological study and use of subsoil and the data at observation points joined in the state basic, agency-level, municipal and local (object) observation networks.

a) Observation points, sites and polygons of the state basic network established through state funding are the property of the state and are located within the areas with natural or damaged subsoil state.

b) Observation points of agency-level and municipal network are run by relevant agencies of the Russian Federation and municipal agencies of the constituent entities of the Russian Federation.

c) Organizations implementing geological prospecting, mining or other activities connected with subsoil use (subsoil users) submit the data on subsoil state to the monitoring system of the MNR of Russia, irrespectively of their status and property type.

Information on the subsoil state received by SMSS refers to state information resources of SMSS, which belong to the state fund of geological information. SMSS information resources are referred to the competence of the Russian Federation, constituent entities of the Russian Federation, joint competence of the Russian Federation and the constituent entities in accordance with the current legislation of the Russian Federation on subsoil and state information resources. Information of SMSS system is to comply with the state standards and requirements set by the MNR of Russia, including the State Bank of digital geological information and funds of geological information.

The procedure and conditions of entering confidential and restricted data

[10] The Statute on Subsoil monitoring gives a clearer statement on the organization levels of environmental monitoring. Four levels are distinguished in this case, while three levels (federal, territorial and local) are a common practice.

containing state secrets into SMSS information fund is determined by the legislation in effect.

MNR of Russia annually submits the summarized information on subsoil state received in the course of the SMSS to the governmental agencies of the Russian Federation, constituent entities of the Russian Federation to be used in decision - taking in the field of nature management.

SMSS information resources are used for the preparation of State reports on the status of mineral resources of the Russian Federation, on the state of the environment in the Russian Federation, on the state and use of lands of the Russian Federation and in the course of state geological and water control.

The functioning and development of the system of state monitoring of subsoil state are funded through:

- costs for reproduction of mineral resources, stipulated by the Federal Law on federal budget for the year under consideration;

- funds of federal programmes, which include activities on the implementation of SMSS;

- own funds of subsoil users and other resource users;

-other sources of funding, not prohibited by the current legislation of the Russian Federation (*Order of the RF MNR from 21/05/2001 No.433 "On adoption of Statute on the procedure of the state monitoring of subsoil state of the Russian Federation"*).

State monitoring of the continental shelf of the Russian Federation, exclusive economic zone of the Russian Federation, inland sea water and territorial sea of the Russian Federation

In accordance with the Federal Law "On inland sea water, territorial sea and adjacent area of the Russian Federation", state environmental monitoring of inland sea water and territorial sea (further referred to as state monitoring), which is part of the unified state system of environmental monitoring of the Russian Federation, is a system of regular observations of the state of marine environment and bottom sediments in terms of physical, chemical, hydrobiological and microbiological parameters and the assessment and forecasting of changes under the impact of natural and anthropogenic factors.

State monitoring is implemented by executive agencies authorized by the Government of the Russian Federation jointly with executive agencies of the constituent entity of the Russian Federation and in accordance with the legislation of the Russian Federation (*Article 36, Federal Law from 31/07/1998 No.155-FZ* (*edited on 9/07/2011 "On inland sea water, territorial sea and adjacent area of the Russian*

Federation").

In accordance with the Federal Law "On continental shelf of the Russian Federation", state environmental monitoring of continental shelf (further referred to as state monitoring), which is part of the unified state system of environmental monitoring of the Russian Federation, is a system of regular observations of the state of the environment, including marine environment and bottom sediments, including the parameters of chemical and radioactive pollution, hydrobiological and microbiological parameters and their changes under the impact of natural and anthropogenic factors.

State monitoring is implemented by federal executive agencies authorized by the Government of the Russian Federation in accordance with the legislation of the Russian Federation (*Article 33, Federal Law from 30/11/1995 No.187-FZ (edited on 18/07/2011 "On continental shelf of the Russian Federation"*).

In accordance with the Federal Law "On exclusive economic zone of the Russian Federation", state environmental monitoring of exclusive economic zone (further referred to as state monitoring), which is part of the unified state system of environmental monitoring of the Russian Federation, is a system of regular observations, assessment and forecasting of the state of marine environment and bottom sediments, including observations of the parameters of chemical and radioactive pollution, hydrobiological and microbiological parameters and their changes under the impact of natural and anthropogenic factors.

State monitoring is implemented by federal executive agencies authorized by the Government of the Russian Federation in accordance with the procedure set by the legislation of the Russian Federation (*Article 29, Federal Law from 17/12/1998 No.191-FZ (edited on 18/07/2011 "On exclusive economic zone of the Russian Federation"*).

In accordance with the Resolution of the Government of the Russian Federation No.372 from 23 July 2004 (edited on 24/03/2011) state environmental monitoring of surface water bodies (they include inland sea water and territorial sea) and the state monitoring of continental shelf and exclusive economic zone of the RF is implemented by the Federal Service for Hydrometeorology and Environmental Monitoring.

Thus, in accordance with the RF legislative acts mentioned above 7 types of state environmental monitoring are carried out in the Russian seas (taking into account that monitoring of fauna objects includes monitoring of game resources and water bioresources). We will not further cover the monitoring of game resources as it covers the narrow coastal water area at its most. The other types of marine environmental monitoring are carried out by the 4 federal executive agencies: a)

Federal Service for Hydrometeorology and environmental monitoring - monitoring of continental shelf, exclusive economic zone and water bodies (including the monitoring of inland sea water and territorial sea) in respect of qualitative and quantitative parameters of water resources conditions; b) Federal Agency for Water Resources - monitoring of water bodies in respect of water protection zone, hydraulic structures, water consumption and water disposal; c) Federal Agency on Mineral Resources - monitoring of subsoil state; d) Federal Agency for Fishery - monitoring of water biological resources.

Monitoring of the environment and its pollution

Legislative background of environmental monitoring (including monitoring of sea water areas) implemented by the Federal Service for Hydrometeorology and environmental monitoring (Roshydromet) is not restricted to the legislative acts mentioned above. It is completed by the Federal Law "On hydrometeorological service", which will be covered further.

In accordance with this Federal Law, hydrometeorological service is a system of functionally joined individuals and legal entities, including executive agencies implementing activities in the field of hydrometeorology and related fields (meteorology, climatology, agrometeorology, hydrology, oceanology, heliogeophysics, the area of active impacts on meteorological and other geophysical processes), *monitoring of environment and its pollution*, including ionosphere and circumterrestrial space and submission of information of information on the state of the environment, its pollution and natural hazards.

In accordance with this law monitoring of environment and its pollution comprises long-term observations of the state of the environment and the ongoing natural phenomena and the assessment and forecasting of the state of the environment and its pollution [11] (*Article 1, Federal Law from 19/07/1998 No. 113-FZ (edited on 11/07/2011) "On hydrometeorological service"*).

Hydrometeorological service conducts its activities on the basis of the following principles:

global and continuous observations of environmental conditions and environmental pollution;

uniformity and compliance of methods of observations of the state of the environment and pollution and methods of collection, processing, storage and distribution of the information received as a result of observations;

[11] This definition is similar to the definition of environmental monitoring given in the Federal Law "On Environmental Protection"; but this law covers anthropogenic factors in general, while the Law "On hydrometeorological service" covers pollution only.

safety of operations on producing active impact on meteorological and other geophysical processes;

integration with national and international systems of environmental monitoring and environmental pollution;

efficiency of the use of information on actual and forecasted state of environment and its pollution;

ensuring validity of information on the state of the environment and its pollution and its accessibility for users (consumers);

compliance of the activities of hydrometeorological service with the tasks of protection of population health, environment protection and securing environmental and hydrometeorological security [12] (*Article 4 of the Federal Law from 19/07/1998 No. 113-FZ (edited on11/07/2011) "On hydrometeorological service"*)

Hydrometeorological service unites executive agencies and other legal entities and individuals. Thus there emerges a need to separate state monitoring performed by the authorities from monitoring performed by other entities. This is done (not quite successfully) with help of the so called State Service for Observations (SSO), which is organized and supported by Roshydromet [13].

The Statute on SSO was adopted by Resolution of the Government of the Russian Federation from 23 August 2000 No. 622. In accordance with this Statute, state system of observations of state of the environment is organized for observation of the ongoing physical, chemical and biological processes, the level of pollution of atmospheric air, soils and water bodies (including hydrobiological parameters) and consequences of this impact on flora and fauna (further referred to as state of environment) and supplying the stakeholders with current and urgent information on changes in the environment, warnings and forecasts of changes in state of the environment .

State service for observations of the state of the environment is implemented

[12] The last principle is important to provide closer connection between pollution monitoring conducted by Roshydromet and informational needs of environment protection. To achieve it these needs should be more specific Undoubtedly, data of environmental monitoring should be wider used for environmental standard setting.

[13] Isn't it an awkward attempt? It would be easier to say that state monitoring of environment and its pollution is implemented by Roshydromet. There are reasons for it: main of which is that the law on hydrometeorological service and the statute on SSO were both adopted in the period when the law on environmental protection ratified in 1992 was in effect (according to this law, functions of environmental monitoring were carried out by state service for observations). When the new law on environmental protection was adopted in 2002 and the responsibilities of federal executive agencies changed within administrative reforms, the reference to SSO in the Statute on Roshydromet became a kind of a safeguard (safe bind, safe find). We should expect that the changes introduced into the Federal Law "On environmental protection" will lead to the abolition of the Statute on SSO (it will be further covered in detail).

by the Federal Service for Hydrometeorology and environmental monitoring through the system of stationary and mobile observation points, including posts, stations, laboratories, centres, bureaus, observatories located in different natural and climatic areas, cities and industrial centres and different water bodies (including water reservoirs and canals) with varied anthropogenic load, space and sea-based observation facilities.

Main tasks of the state system of observations of the state of the environment are as follows [14]:

1) securing observations of the state of the environment, assessing the ongoing changes and forecasting of the following hazards and factors:

natural disasters caused by weather and climate reasons (floods, hurricanes, draughts, mudflows, avalanches etc.);

unfavourable natural conditions for certain spheres of economic activities (agriculture, forest and water management, energy, construction, transport etc.);

anthropogenic changes of state of the environment, including its chemical, radioactive and thermal pollution, physical, chemical and biological (for water bodies) processes;

changes of natural composition of natural environments;

climate change;

2) provision of governmental agencies of the Russian Federation, constituent entities of the Russian Federation and local authorities with the data on actual state of the environment, its pollution and information on ongoing and forecasted changes in its state;

3) provision of agencies and organizations making up the Unified state system of emergency prevention and liquidation with real-time actual and prognostic information on the state of the environment to provide security of population and to decrease economic damage from natural and anthropogenic emergencies;

4) provision of the state sanitary and epidemiological supervision of the Russian Federation with the required information on the state of environment to solve tasks of social and hygienic monitoring;

[14] As it follows from the task list, the main function of SSO (and Roshydromet) in the environmental monitoring is notification. However in most cases the list of information submitted by Roshydromet to other federal executive agencies and constituent entities of the federation is not clearly specified (especially in terms of information designed for nature protection purposes). The list of information of common use issued by Roshydromet and submitted to consumers free of charge (see Annex 3) is determined in the Resolution of the RF Government No. 1425 from 15 November 1997 (in edition of Resolution of the RF Government No. 214 from 28 March 2008). Requirements for additional information often cause interagency conflicts, as the information services provided by Roshydromet institutions beyond this list are charged, which consumers generally don't like. The issues of information exchange are covered in Section 1.3 in detail.

5) provision of specially authorized state agencies of the Russian Federation in the field of environment protection with the required information for the integrated analysis and assessment of the state of environment and the use of natural resources;

6) provision of stakeholders with current and urgent information on changes in the environment, warnings and forecasts of its state;

7) coordination of functioning of agency-level and territorial observation networks to implement integrated assessment and forecasting of the ongoing changes;

8) ensuring completeness and validity of information on the state of the environment and the compliance of this information within the whole area of the country, improvement of the use of on-land, aviation and space observation systems;

9) submission of the required information on the state of the environment and its pollution to the Unified data fund, other funds and data banks on the state of the environment;

10) coordination of functioning of agency-level and territorial networks aimed at observation of the state of the environment with analogous international and national systems.

The Federal Service for Hydrometeorology and environmental monitoring of Russia and its territorial agencies jointly with other authorized state agencies of the Russian Federation in the field of environmental protection and its territorial agencies alongside with other federal executive agencies and executive agencies of the RF constituent entities ensure the development and functioning of the state observation network, the system of collection, processing, recording, storage and distribution of information on the state of environment.

To receive special information on the state of the environment executive agencies of the constituent entities of the Russian Federation and local authorities can establish territorial observation networks. The procedure and conditions of the coordinated functioning of territorial observation networks within the framework of the state system of observations of the state of the environment are determined by the joint decisions of the executive agencies of the constituent entities of the Russian Federation and federal executive agencies within their competence or local authorities and federal executive agencies within their competence.

As it follows from our review, the legal and regulatory framework of environmental monitoring of Russian seas includes seven Federal Laws as the basic legal and regulatory acts ("On Environmental Protection", "On hydrometeorological service", "Water Code", "On Fishery and Conservation of Water Biological Resources", "On inland sea waters, territorial sea and the adjacent zone", "On continental shelf", "On exclusive economic zone"), four Resolutions of the RF

Government ("On organization and implementation of environmental monitoring", "On implementation of monitoring of water bodies", "On implementation of monitoring of water biological resources", "On state service for observations") and several agency-level acts, e.g. "On procedure of implementation of state monitoring of subsoil".

1.2. Organization of observations of state and pollution of the marine environment

It is common knowledge that one of the main documents regulating monitoring is the programme determining the number and location of observation points, the list of observed parameters, location of points, terms and periodicity of observations. Sometimes the organization of monitoring is covered not in the long-term programme, but in the annual plans of observations (research).

The observations can be carried out in accordance with the accepted procedure (it is typical of the monitoring of water biological resources) or in accordance with certain rules stated in reference documents (typical of the monitoring of state and pollution of marine environment).

Despite substantial legislation behind the monitoring of state and pollution of marine environment performed by Roshydromet (in the list given above this monitoring is covered by 6 out of 7 federal laws and 3 out of 4 resolutions of the RF Government) the rules of this monitoring are directly regulated by only one reference document adopted almost 30 years ago during the Soviet period.

This is GOST 17.1.3.08-82 "Rules of sea water quality control", which set the rules of quality control of the water of seas and estuarine zones by physical, chemical and hydrobiological parameters, and is implemented by the State Service for Observations and Control of Environment Objects Pollution (SSOC)[15]. Main statements of this document are listed below.

Designation and location of control points

SSOC control points are subdivided into categories I, II and III. Categories depend on the location and capacity of pollution sources, composition, concentration and forms of pollutants, physical - geographical and regional peculiarities. The borders of controlled areas are determined for each sea and estuary separately accounting for hydrometeorological regime, distribution of pollutants and physical and geographical characteristics.

[15] Currently -the State Service for Observations

Category I control points are designed to control sea water quality in coastal areas of great economic importance. The points must be located in the areas of water supply, in the areas of spawning, foraging and seasonal accumulations of fish and other marine organisms, in ports and near-port areas, the sites of urban, industrial and agricultural sewage discharge, in the sites of exploration, production, development and transportation of mineral resources and in the estuaries of large rivers.

Category II control points are designed to control sea water quality in coastal areas and in high sea for the study of seasonal and annual variability of sea water pollution. The points must be located in the areas where pollutants inflow as a result of migration processes.

Category III control points are designed to control sea water quality in high sea for the study of annual variability of sea water pollution and calculation of the balance of chemical substances.. The points must be located in the areas with minimal concentrations of pollutants

Programmes and periodicity of control

The observations at control points are carried out in accordance with full and short programmes presented in Annex 2.

Sampling horizons and the list of parameters controlled at sea points are presented in Table 1.1.

Table 1.1.

Sampling horizons in the sea

Sampling horizons, m	Controlled parameters			
	Oil hydrocarbons, chlorohydrocarbons	Synthetic surfactants phenols	Heavy metals	Remaining observations from full or short programme
0	In progress	In progress	In progress	In progress
5	In progress	Not carried out	Not carried out	Not carried out
10	In progress	In progress	In progress	In progress
20	In progress	Not carried out	Not carried out	In progress
50	Not carried out	Not carried out	Not carried out	In progress
100	Not carried out	Not carried out	Not carried out	In progress
500	Not carried out	Not carried out	In progress	In progress
1000	Not carried out	Not carried out	In progress	In progress
At bottom	In progress	In progress	In progress	In progress

Notes:

1. Zooplankton samples are taken by plankton net (No.38) in layers 0-10, 10-25, 25-50, 50-100, 100-200, 200-500 m.

2. Additional sampling depth is the temperature transition layer.

For control points located in the outlet of the estuary the number of verticals depending on the river (branch) width and the sampling horizons depending on the river (branch) depth are presented in table 1.2 and 1.3

Table 1.2.

The location of verticals in the outlet of estuary depending on the river (branch) width

Width of the river in the estuary or delta branch, m	Number of verticals		
	1	3	5
Less than 100	Located	-	-
100-1000	-	Located	-
More than 1000	-	-	Located

Note: One vertical is located in the riverbed centre, other verticals are evenly located along its width

Table 1.3.

Sampling horizons in the outlet of estuary depending on the river (branch) depth

River depth in the estuary, m	Sampling horizons			
	Surface	0.5 of the depth	At bottom	Every 5 m
1-5	In progress	Not carried out	In progress	Not carried out
5-10	In progress	In progress	In progress	Not carried out
More than 10	In progress	Not carried out	In progress	In progress

Note: When density transition zone is clearly distinguished, additional samples are taken in this horizon.

Observations periodicity and control programmes are presented in the following table:

Periodicity of control	Control programmes for categories		
	I	II.	III
Twice a month (1st and 3rd 10 day periods)	Reduced Programme	Not carried out	
Once a month (2nd 10 day period)	Full Programme	Not carried out	
5-6 times a year depending on hydrometeorological conditions	Not carried out	Full Programme	Not carried out
2-4 times a year depending on hydrometeorological conditions	Not carried out		Full Programme

Control point category and the list of controlled parameters can be changed in accordance with the established procedure in case of emergence of new pollution sources, changes of capacity, content and forms of old pollution sources, the changes in water supply type or other conditions.

Provision of stakeholders with systematic information on the mentioned parameters of sea water quality and on their probable changes under the impact of economic activities and hydrometeorological conditions is carried out in accordance with the established procedure.

In the Caspian Sea (within the Russian sector of subsoil use), observations of the state and pollution of the marine environment are held: at 1 station of category I located in the water area of Makhachkala port, at 33 stations of category II located near the western coast of the Middle Caspian, at 22 stations of category III located at century cross-sections III, IIIa and IV. The list of controlled hydrochemical parameters is in accordance with GOST 17.1.3.08-82. Hydrobiological observations are held only at century cross-sections and the number of controlled hydrobiological parameters is limited to number, biomass and species composition of phytoplankton.

State monitoring of subsoil conditions and water biological resources is held on the basis of annual plans as there are no reference documents which set requirements to the organization of an observation network. Scope of observations can vary significantly depending on funding conditions. State monitoring of water bioresources as a rule includes hydrobiological observations (number, biomass, species composition of phytoplankton, zooplankton and zoobenthos), ichthyology research (abundance, stocks, age and sex composition, physiological condition of commercial fish species), observations of hydrocoles habitat (hydrochemical parameters and indicators of marine environment pollution). State monitoring of subsoil state includes the determination of physical and chemical parameters of the surface layer of sea sediments and observations of the pollution level.

Thus, the organization of network of observations of the Russian seas environmental conditions has not accumulated normative-technical documents (NTD). The situation is different in respect to methods of measuring environmental parameters having quite a wide normative-technical background.

For instance we can point to NTD regulating water and bottom sediments sampling, which include standards GOST 17.1.5.01-80 "Nature protection. Hydrosphere. Hydrosphere. General requirements for sampling bottom sediments in water bodies for pollution analysis", GOST 17.1.5.01-85 "Nature protection. Hydrosphere. General requirements for sampling surface and sea water, ice and atmospheric precipitations", RD 52.17.262.91 "Methods of

sampling, processing and concentration of samples of sea water, ice, snow cover, bottom sediments and zoobenthos samples during sea expeditions", GOST R 51592-2000 ""Water. General requirements to sampling". Technical tools used for sampling of sea water and bottom sediments must meet the requirements of GOST 17.1.5.04-81 "Nature protection. Hydrosphere. Instruments and devices for sampling, primary processing and storage of samples. Basic technical conditions".

Methods of chemical analysis used for carrying out environmental monitoring should be included in the list of federal regulatory documents for nature protection . Measurement instruments should be included in the national register of measurement instruments. Sufficient attention in Russia is paid to ensuring measurements uniformity and the development and improvement of its regulatory background , but we will not dwell on the issue.

1.3. Information exchange among monitoring participants and provision of information services for consumers

As environmental monitoring is split into different types, almost every of them requires additional data from other monitoring types (or other monitoring participants) to implement its functions. The issues of information submission and exchange in some cases are regulated in accordance with the accepted standards.

Order of the RF Ministry of Nature from 27 December 2007 No. 349 adopted the procedure of exchange of data of state monitoring of water bodies among its participants. This procedure was developed in accordance with Item 9 of the Statute on state monitoring of water bodies adopted by Resolution of Government of the Russian Federation from 10 April 2007 No.219 "On adoption of Statute on implementation of state monitoring of water bodies" and regulates informational cooperation between Federal Agency for Water Resources, Federal Service for Hydrometeorology and environmental monitoring, Federal Agency on Mineral Resources, Federal Service for the Oversight of Natural Resources and authorized executive agencies of constituent entities of the Russian Federation (further referred to as monitoring participants) in the implementation of state monitoring of water bodies.

Exchange of data on state monitoring of water bodies is implemented to:

provide information support for management in the field of use and protection of water bodies, including state surveillance over the use and protection of water bodies;

timely identify and forecast the development of negative processes affecting water quality and state of water bodies;

assess the efficiency of activities implemented to protect water bodies;

Exchange of data on state monitoring of water bodies includes the exchange of data received by monitoring participants in the course of:

monitoring of surface water bodies taking into account data of monitoring carried out in the course of operations in hydrometeorology and related fields;

monitoring of state of water bodies bottom and shores and the state of water protection zones;

monitoring of ground water taking into account the data of state monitoring of subsoil conditions;

observations of water economic systems, including hydraulic structures and water volume in the course of water consumption and disposal.

Exchange of data on state monitoring of water bodies also includes the data from data banks of state monitoring of water bodies formed by the Federal Agency for Water Resources, including the data received from stakeholders among federal executive agencies, owners of water bodies and water consumers.

Exchange of data on state monitoring of water bodies among monitoring participants and the submission of data on state monitoring of water bodies to federal executive agencies, governmental agencies of constituent entities of the Russian Federation, local authorities, legal entities and individuals are performed in accordance with water legislation, Model Regulation of interaction between federal executive agencies adopted by Resolution of the Government of the Russian Federation from 19 January 2005 No.30 "On Model Regulation of interaction between federal executive agencies" and in accordance with the procedure established by Federal Law from 27 July 2006 No. 149-FZ "On information, information technologies and information protection".

Exchange of data on state monitoring of water bodies is implemented between federal executive agencies and their territorial agencies as well as the territorial agencies of federal executive agencies and authorized executive agencies of the constituent entities of the Russian Federation.

Exchange of data on state monitoring of water bodies among monitoring participants is implemented through submission of the documented data on state monitoring of water bodies in hard and (or) soft copies.

In case data files on state monitoring of water bodies are submitted on electronic media, the cover letter includes the number of submitted files, their names, size, modification date and the volume of data.

If possible data submitted on electronic media are certified by electronic digital

signature in accordance with Federal Law from 10 January 2002 No.1-FZ "On electronic digital signature".

Monitoring participants submit the data on state monitoring of water bodies directly or by mail as a letter with declared value and mail notification.

Monitoring participants submit the data on state monitoring of water bodies free of charge (*Order of the RF MNR from 27/12/2007 No.349 "On adoption of the Procedure of exchange of data on state monitoring of water bodies among monitoring participants"*)

The procedure and forms of submission of monitoring data received by participants of state monitoring of water bodies were ratified by Order of the RF Ministry of Nature No.111 from 07 May 2008. This procedure was elaborated in accordance with the Statute on implementation of state monitoring of water bodies, ratified by Resolution of the Government of the Russian Federation from 10 April 2007 No. 219 "On adopting the Statute on the implementation of state monitoring of water bodies" and determines the content, periodicity, terms and procedure of free submission to the Federal Agency for Water Resources of the monitoring data received by Federal Service for Hydrometeorology and environmental monitoring, Federal Agency on Mineral Resources, Federal Service for Oversight of Natural Resources and authorized executive agencies of the constituent entities of the Russian Federation (further referred to as participants of state monitoring of water bodies) in the course of monitoring activities within the established competence.

The monitoring data received by the Federal Service for Hydrometeorology and environmental monitoring, Federal Agency on Mineral Resources, Federal Service for Oversight of Natural Resources are submitted to the Federal Agency for Water Resources.

Monitoring data received by authorized executive agencies of the constituent entities of the Russian Federation are submitted to the relevant territorial agencies of the Federal Agency for Water Resources.

Monitoring data received by participants of state monitoring of water bodies are submitted annually within the prescribed time limit.

Federal Service for Hydrometeorology and environmental monitoring submits the data of monitoring of surface water bodies taking into account data of monitoring carried out in the course of operations in hydrometeorology and related fields.

The Federal Service for Hydrometeorology and environmental monitoring submits the summarized data of regular hydrological observations and hydrochemical observations of water quality of water bodies surface to the Federal Agency for Water Resources for the previous year starting from 2009.

The scope of data submitted by the Federal Service for Hydrometeorology and environmental monitoring for every year is specified upon agreement with the Federal Agency for Water Resources.

The actual and prognostic information, including urgent information on changes in state of water bodies in terms of qualitative and quantitative parameters (hazardous water levels, emergency and extreme water pollution) is submitted in accordance with the Agreement on interaction in the field of hydrometeorology and water bodies monitoring between the Federal Service for Hydrometeorology and environmental monitoring and Federal Agency for Water Resources.

Federal Agency on Mineral Resources submits summarized data of regular observations of the state of ground water bodies, including observations of ground water quality, assessment and forecasting of changes of the state of ground water bodies.

Federal Service for Oversight of Natural Resources submits summarized data of regular observations of the usage regime of water protection zone of Lake Baikal, observation of usage regimes of the exclusive economic zone, inland sea waters and territorial sea of the Russian Federation and the data of observations of the supervised hydraulic structures.

The authorized executive agencies of the constituent entities of the Russian Federation submit:

1) data of regular observations of water bodies, the state of bottom, shores and water protection zones of water bodies;

2) data of observations of hydraulic structures owned by the constituent entities of the Russian Federation;

3) data on infringements of usage regime of water protection zones received as a result of regional state control and oversight of the use and protection of water bodies.

The monitoring data received by Federal Agency on Mineral Resources, Federal Service for Oversight of Natural Resources and authorized executive agencies of the constituent entities of the Russian Federation are submitted for the expired year period.

The information on accidents and other emergencies in water bodies received in the course of the state monitoring of water bodies is submitted immediately to the relevant territorial agencies of the Federal Agency for Water Resources.

The monitoring data received by participants of state monitoring of water bodies are submitted on electronic media as files with a cover letter including the number of submitted files, their names, size, modification date and the volume of submitted data (number of objects and number of completed lines of data submission

forms). If possible the monitoring data received by participants of state monitoring of water bodies are certified by electronic digital signature.

Monitoring data received by participants of state monitoring of water bodies are submitted to the Federal Agency for Water Resources and its territorial agencies directly or by mail as a letter with declared value and mail notification.

Participants of state monitoring of water bodies are responsible for completeness and validity of monitoring data submitted to the Federal Agency for Water Resources and its territorial agencies.

The procedure and forms of submission of data received as a result of observations of water bodies by stakeholders among federal executive agencies and owners of water bodies and water consumers are ratified by Order of the RF Ministry of Nature from 06 February 2008 No.30. This procedure was elaborated in accordance with the Statute on implementation of state monitoring of water bodies adopted by Resolution of the Government of the Russian Federation from 10 April 2007 No.219 "On adoption of Statute on implementation of state monitoring of water bodies" and determines the procedure of free submission of data required for the state monitoring of water bodies by the stakeholders among federal executive agencies, owners of water bodies and water consumers.

Federal Service for Environmental, Technological, and Nuclear Supervision, Federal Service for the Oversight of Consumer Protection and Welfare, State Committee of the Russian Federation for Fishery, Federal Service for the Oversight of Transport and federal executive agencies supervising state-owned hydraulic structures submit the data required for monitoring to the Federal Agency for Water Resources.

Federal Service for Environmental, Technological, and Nuclear Supervision submits the data received through control and oversight of the supervised hydraulic structures and through state environmental control in respect of negative anthropogenic impact on water bodies.

Federal Service for the Oversight of Consumer Protection and Welfare submits the data received through social - hygienic monitoring on assessment of water quality in drinking and public water supply and on the assessment of the state of water bodies used for recreation.

State Committee of the Russian Federation for Fishery submits the data received through monitoring of state of water biological resources in respect of the assessment of state of water bodies as a habitat of water biological resources.

Federal Service for the Oversight of Transport submits the data received through control and oversight of marine (including sea commercial, specialized and

fishing ports with the exception of ports belonging to fishing collective farms) and inland water transport.

Federal executive agencies supervising organizations exploiting state-owned hydraulic structures submit the data received through observations of relevant water economic systems including hydraulic structures.

Owners of water bodies and water consumers submit the data received through observations of water bodies (their morphometric characteristics) and their water protection zones to the relevant territorial agencies of the Federal Agency for Water Resources.

The data received through observations of water bodies by federal executive agencies, owners of water bodies and water consumers must be updated as of first day of the month following the reporting year.

The data on emergencies and accidents in water bodies, water economic systems, hydraulic structures or other water facilities, activities on liquidation of consequences of emergencies and accidents are submitted immediately to the relevant territorial agencies of the Federal Agency for Water Resources.

The data on observations of water bodies are submitted on electronic media as files with a cover letter, which contains the number of submitted files, file names, size, modification dates and the volume of submitted data (number of objects and filled lines in data submission forms). If possible the submitted data are certified by electronic digital signature.

The data are submitted to the Federal Agency for Water Resources and its territorial agencies directly or by mail as a letter with declared value and mail notification.

Federal Agency for Water Resources enters the specified data into data banks of state monitoring of water bodies for watershed districts, water economy sites and territories of constituent entities of the Russian Federation and the Russian Federation as a whole.

As far as marine environment protection is concerned, information on discharges of sewage water and pollutants to the sea is of primary importance. In accordance with the Statute on implementation of state monitoring of water bodies water consumers keep record of sewage water and its quality and submit these data to territorial agencies of Federal Agency for Water Resources in accordance with the established form and periodicity. Periodicity of control and the list of pollutants which concentration is measured in sewage water are established when the standards of permissible discharges (SPD) are elaborated and endorsed in accordance with the method adopted by Order of the RF MNR No.333 from 17/12/2007.

In accordance with this method the range of controlled substances at a first approximation is limited to pollutants which concentration is regulated in the sea water. The list of substances which maximum permissible concentrations (MPC) in sea water were adopted was updated in 2010. In accordance with Order of Rosrybolovstvo No.20 from 18/01/2010 "On adopting of water quality standards for water bodies of fishery importance" this list includes 103 substances. Standards for 3 more indicators (biochemical oxygen demand (BOD), chemical oxygen demand (COD) and solids) are set by SanPin (sanitary regulations and standards) 2.1.5.2582-10 "Sanitary-epidemiological requirements to protection of marine coastal water".

In accordance with the method mentioned above the list of pollutants which concentration is measured in sewage water includes the pollutants (out of those which standards are set for sea water) which are detected in sewage water. Standards of permissible discharges are set for these substances.

Generally standards of permissible discharges can be set for all the pollutants standardized in sea water and present in sewage water. In practice however SPDs are set only for those substances which discharge to the sea is charged.

The list of substances which discharges to the surface water (including seas) are charged was adopted by the RF Government in 2003 (Resolution of the RF Government No.344 from 12/06/2003). This list comprises 143 substances, but quality standards of sea water are adopted only for 26 substances, so SPD can be applied to them only. Neither entities discharging sewage waters nor entities performing state environmental control have reasons to go beyond these limits, so only these 26 substances are subject to control in practice.

Entities discharging water are responsible for keeping statistical records of sewage water and the quantity of discharged pollutants. This responsibility creates the legal background for determination of the list of substances to be controlled In accordance with the Federal plan of statistical operations, Federal Agency for Water Resources is the federal executive agency responsible for official statistical recording and compiling official statistical information in this field.

The form of state statistical observations [N2-TP (vodkhoz) "Data on water use"] was adopted by Rosstat order No.230 from 19/10/2009. The annexes to instruction on filling this form include the list of pollutants of 163 substances, which are to be recorded by respondents. However in practice statistical recording and data submission to Rosvodresursy and Rosstat deal only with the substances for which SPDs were adopted and which discharge to the sea is charged, i.e. the 26 substances we have dwelt on above (this information is submitted once a year).

Federal information resources on pollutants entering the sea with sewage water include the data on sewage water volume and category (purified, insufficiently

purified, not purified) and on the quantity of discharged pollutants which list is presented in table 1.4. Only part of this information is available for public use. For example, the publicly-accessed central statistical database of Rosstat (http://www.gks.ru/dbscripts/Cbsd/DBInet.cgi) comprises the data on discharges of 10 substances. The state report "On the state and protection of environment in the Russian Federation" includes data on discharges of 10 pollutants (http://www.mnr.gov.ru/regulatory/list.php?part=1101).

Table 1.4.

The list of substances which concentration is regulated in sea water, which discharges are charged and subject to statistical recording

No. Item	Name of the pollutant	MPC in sea water mg/dm3	N in the list of water quality standards in fishery water bodies	N in the list of substances which discharges are charged	Substance code in Rosstat list.
1	Ammonium ion	0.5	54	1	3
2	Sodium alkyl-sulfonate	0.005	661	3	201
3	Boron	15	110	9	6
4	Suspended matter	10	143	13	113
5	Iron (all forms dissolved in water)	0.05	344	20	13
6	Cadmium	0.01	386	22	15
7	Potassium	390	387	23	58
8	Calcium	610	393	24	59
9	Cobalt	0.005	412	32	16
10	Magnesium (all forms dissolved in water)	940	494	37	20
11	Manganese (2+)	0.05	496	38	21
12	Copper (2+)	0.005	501	41	22
13	Methanol	0.1	506	42	23
14	Arsenic	0.01	569	46	25

15	Sodium	7100	571	47	65
16	Oil and oil products	0.05	600	48	80
17	Nickel	0.01	602	50	27
18	Synthetic surfactants	0.1	648	57	36
19	Mercury	0.0001	743	62	34
20	Lead (all forms dissolved in water)	0.01	749	64	35
21	Strontium	4.14	799	143	127
22	Sulphate-anion	3500	801	69	40
23	Chloride -anion	11900	964	87	52
24	DDT	0.00001	972	103	100
25	Zinc	0.05	1018	90	55
26	BOD_5*	2			132

Note: sanitary standard is given for BOD; it also has no number in the list of substance, which discharges are charged, as special payment calculation procedure is applied.

Legal and regulatory acts regulating activities in the field of monitoring of environmental conditions and pollution cover the issues of information exchange among monitoring participants and information services for consumers in more detail. The definitions of basic terms and concepts are given in the federal law "On Hydrometeorological Service" (*Federal Law from 19/07/1998 No.113-FZ (edited on 11/07/2011) "On Hydrometeorological Service"*). Note the following ones:

information on the state of environment and its pollution is the data received through monitoring of environment and its pollution;

information product is the summarized information received through data processing aimed for distribution or sale;

urgent information includes immediate storm alerts and (or) storm warnings and instantly transmitted information on actual and forecasted rapid changes of weather and environment pollution which can pose a threat to life or health of population and damage the environment;

general purpose information is the information on actual or forecasted state of the environment and its pollution received and processed in accordance with the procedure established by a federal executive agency in the field of hydrometeorology or a related field and submitted to consumers free of charge;

special information is the information submitted under the order of consumers and at their expense;

information producer is an individual or a legal entity processing data received

through monitoring of the environment and its pollution;

data fund on the state of environment and its pollution is the combination of data and information products subject to long-term use and storage;

storm alert is the information on forecasted natural hazards;

storm warning is the information on the natural hazard which has already started.

Legal background for usage of information on the state of environment and its pollution and information products is determined in Chapter IV of Federal Law "On hydrometeorological service".

In accordance with Article 14 information on the state of the environment and its pollution and information products are in open and public access with the exception of the information which access is restricted by the legislation of the Russian Federation.

General-purpose information refers to federal information resources in the field of hydrometeorology and related fields.

In accordance with Article 15 the Unified State Data Fund on the state of the environment and its pollution is compiled through collection, processing, recording, storage and distribution of documented information on the state of the environment and its pollution.

The content and structure of the documented information on the state of the environment and its pollution, the procedure of its compiling, recording, storage and use as well as the procedure of establishment and supporting of the unified data fund on the state of the environment and its pollution are determined by the federal executive agency authorized by the Government of the Russian Federation.

The documented information on the state of the environment and its pollution included in the Archive Fund of the Russian Federation in accordance with the established procedure is stored in accordance with the Federal Law from 22 October 2004 No.125-FZ "On archive keeping in the Russian Federation".

In accordance with Article 16 legal entities irrespectively of their legal status and individuals collecting information on the state of the environment and its pollution are to submit this information to the federal executive agency in hydrometeorology or a related field in accordance with the procedure established by the federal executive agency authorized by the Government of the Russian Federation.

Legal entities irrespectively of their legal status and individuals collecting information on the state of the environment and its pollution are to immediately submit information on emergencies of anthropogenic nature which have produced or

can produce a negative impact on the environment into the federal executive agency in hydrometeorology or a related field in accordance with the procedure established by the federal executive agency authorized by the Government of the Russian Federation.

In accordance with Article 17 the information on the state of the environment and its pollution and information products are submitted to consumers free of charge or on contract basis in accordance with the legislation of the Russian Federation.

General-purpose information is delivered to consumers as written texts, tables or graphs via electric or post communication, through mass media as regular communications or upon request of consumers.

Special information is delivered to users (consumers) on a contract basis.

Federal executive agency in the field of hydrometeorology and related fields is to inform users (consumers) of the content of the submitted information on the state of the environment and its pollution, on the ways this information is delivered and on organizations providing information services to users (consumers).

The submission procedure of information on the state of the environment and its pollution to individuals and legal entities of foreign states is established by international treaties of the Russian Federation and legislation of the Russian Federation on participation in international information exchange in the field of hydrometeorology and related fields and other normative legal acts of the Russian Federation.

The Statute on submission of information on the state of the environment and its pollution and anthropogenic emergencies which have produced or produce or can produce a negative impact on the environment was adopted by Resolution of the Government of the Russian Federation from 14 February 2000 No.128.

This Statute sets the procedure of submission of information on the state of the environment and its pollution and anthropogenic emergencies which have produced or can produce a negative impact on the environment to the Federal Service for Hydrometeorology and environmental monitoring. This information is received on the territory of the Russian Federation, including inland sea waters, territorial sea and the air space above them, within the exclusive economic zone, in continental shelf of the Russian Federation, in ionosphere and circumterrestrial space using different tools of information collection.

The information on the state of the environment, its pollution and anthropogenic emergencies which have produced or can produce a negative impact on the environment in accordance with the Federal Law "On hydrometeorological service" is to be provided by legal entities irrespectively of their legal status, and

individuals collecting information on the state of the environment and its pollution.

The submission of information on the state of the environment and its pollution and anthropogenic emergencies which have produced or can produce a negative impact on the environment to the Federal Service for Hydrometeorology and environmental monitoring is carried out to:

meet the requirements of the state, legal entities and individuals for hydrometeorological and heliographic information and the information on the state of environment and its changes;

timely identify and forecast environmental pollution, the development of natural hazards and rapid changes of weather which can pose a threat to life and health of the population, flight safety and navigation and damage the environment and economy;

keep the Unified state data fund on the state of environment and its changes.

General-purpose information and special information on the state of the environment is submitted to the Unified state data fund on the state of the environment and its pollution in accordance with the Statute on the establishment and supporting of the Unified state data fund on the state of the environment and its pollution

The list of information on anthropogenic emergencies which have produced or can produce a negative impact on the environment and the list of territorial agencies receiving this information are determined by the Federal Service for Hydrometeorology and environmental monitoring upon agreement with stakeholders among federal executive agencies of the constituent entities of the Russian Federation.

The information on anthropogenic emergencies which have produced or can produce a negative impact on the environment is immediately submitted to the territorial agencies of the Federal Service for Hydrometeorology and environmental monitoring.

The scope of information and the submission terms are determined by the mentioned territorial agencies upon agreement with legal entities and individuals submitting this information.

The scope and the terms of submission of information on the state of environment, its pollution and anthropogenic emergencies which have produced or can produce a negative impact on the environment by the Military Forces of the Russian Federation are determined by special agreements between the Ministry for Defence of the Russian Federation and the Federal Service for Hydrometeorology and environmental monitoring.

The information on the state of environment, its pollution and anthropogenic

emergencies which have produced or can produce a negative impact on the environment received in the inland sea water, territorial sea, exclusive economic zone and continental shelf of the Russian Federation including operations within international treaties of the Russian Federation, is submitted by vessel captains (expedition leaders) to the closest agency-level coastal radio centre (radio station) of the Marine Fleet Service of the Ministry of Transport of the Russian Federation or State Committee for fishery of the Russian Federation in accordance with the standard procedures of the World Meteorological Organization; the information on oil spills is submitted immediately.

The coastal radio centres (radio stations) transmit the received information to the closest territorial agency of the Federal Service for Hydrometeorology and environmental monitoring.

Federal executive agencies, executive agencies of the constituent entities of the Russian Federation and local authorities support the Federal Service for Hydrometeorology and environmental monitoring in activities aimed at ensuring submission of information on the state of environment, its pollution and anthropogenic emergencies which have produced or can produce a negative impact on the environment by legal entities and individuals.

The Statute on the establishment of the Unified State Data Fund on the state of environment and its pollution was adopted by Resolution of the Government of the Russian Federation from 21 December 1999 No.1410.

This Statute sets the procedure for establishment and keeping of the Unified State Fund of Data on the State of the Environment and Environmental Pollution (further referred to as Unified State Data Fund). Its main task is to accumulate and store information on the state of environment and its pollution to deliver this information to industries, Military Force of the Russian Federation and population of the country.

The Unified State Data Fund is an organized and constantly updated combination of documented information on the state of environment and its pollution received through activities of the Federal Service for Hydrometeorology and environmental monitoring, other stakeholders among federal executive agencies, their territorial agencies, executive agencies of the constituent entities of the Russian Federation, individuals and legal entities irrespectively of their legal status in the field of hydrometeorology and related fields (meteorology, climatology, agrometeorology, hydrology, oceanology and heliogeophysics), monitoring of the state of environment and its pollution (further referred to as participants of activities in the field of

hydrometeorology and related fields) [16].

The Unified State Data Fund comprises documents containing general-purpose information and special information in the field of hydrometeorology and related fields.

General-purpose information refers to federal information resources in the field of hydrometeorology and related fields.

Information of the Unified State Data Fund is open and publicly-accessed with the exception of information for which access is restricted by the legislation of the Russian Federation.

Centralized recording of the documents of the Unified State Data Fund, methodical guidance on completing, recording, systematization of documents and their structure, ensuring their integrity and compliance of data formats on electronic media are implemented by the All-Russian Research Institute of Hydrometeorological information - World Data Centre (further referred to as World Data Centre) in accordance with the procedure established by the Federal Service for Hydrometeorology and environmental monitoring in accordance with the legislation of the Russian Federation on the Archive Fund of the Russian Federation and archives and normative legal acts of the Federal Archival Agency of Russia.

The list of data for centralized recording and the terms of their submission to the World Data Centre are agreed by the participants of activities in the field of hydrometeorology and related fields with the Federal Service for Hydrometeorology and environmental monitoring.

Participants of activities in the field of hydrometeorology and related fields ensure completion and storage of documents which refer to the Unified State Data Fund upon agreement with the Federal Service for Hydrometeorology and environmental monitoring.

Participants of activities in the field of hydrometeorology and related fields are to submit general-purpose information which refers to the Unified State Data Fund to the World Data Centre.

[16] We should note that the activity in the field of hydrometeorology and related fields in the Russian Federation is subject to licensing (in accordance with the Federal Law "On licensing of some activity types" N99-FZ from 04/05/2011). For the past decade three Resolutions of the RF Government have been adopted (No. 324 from 20/05/2002, No. 497 from 13/08/2006 and No. 1216 from 30/12/2011); each consecutive resolution calls off the effect of the previous ones. One of the main license requirements in all the documents is the submission of information received by participants of activities in the field of hydrometeorology and related fields to the Unified State Fund of Data on the State of the Environment and Environmental Pollution. However the last document adopted in December 2011 states that the activities in the field of hydrometeorology and related fields carried out in the course of engineering surveys are not subject to licensing. Thus the range of entities which activities are subject to licensing was narrowed. Actually it includes only Roshydromet institutions. Now it is obvious that the licensing itself which is also carried out by Roshydromet has lost its point completely.

Special information in the field of hydrometeorology and related fields which refers to the Unified State Data Fund can be submitted to the World Data Centre on a contract basis [17].

World Data Centre informs consumers of the organizations providing information services and the content of the Unified State Data Fund.

Federal Service for Hydrometeorology and environmental monitoring controls the formation of the Unified State Data Fund and ensures document safety employing specialists of the Federal Archival Agency of Russia, other stakeholders among federal executive agencies, executive agencies of the constituent entities of the Russian Federation (upon agreement).

The statute on information services in the field of hydrometeorology and environmental monitoring was adopted by Resolution of the Government of the Russian Federation from 15 November 1997 No. 1425.

This Statute regulates the issues of information services provision by the Federal Service for Hydrometeorology and environmental monitoring (Roshydromet) to information addressees irrespectively of their legal status.

Information services in the field of hydrometeorology and environmental monitoring imply the submission of real time and prognostic, analytical, reference, general-purpose and special information by Roshydromet organizations.

General-purpose information in the field of hydrometeorology and environmental monitoring is submitted to information consumers free of charge or for payment which does not cover the costs of these services (see Annex 3). The costs of these services are compensated for by the federal budget.

The general-purpose information in the field of hydrometeorology and environmental monitoring is submitted to governmental agencies of the Russian Federation, governmental agencies of the constituent entities of the Russian Federation and agencies of the unified state system for prevention and liquidation of emergencies free of charge.

Other consumers of general-purpose information in the field of

[17] The main drawback of the Statute on the establishment and supporting of the Unified State Data Fund is complete disregarding of rights of private individuals - participants of activities in the field of hydrometeorology and related fields for the information on the state of environment and its pollution received by the on their own (at their expense, for their own purposes or for sale). These individuals being owners and managers of this information should reserve their rights for it after the information is passed to the Unified State Data Fund. The only possibility for it is the contract mentioned in the text. We should note the inadequacy of the term *special information*, which definition in the Federal Law "On hydrometeorological service" states only the way of its submission without saying anything of receipt conditions.

hydrometeorology and environmental monitoring are supplied with this information for payment compensating the costs for its preparation, copying and transmission via communication channels, including the Internet and postal service.

Special information in the field of hydrometeorology and environmental monitoring is submitted to information consumers within the framework of joint programmes (agreements) and contracts for services on information provision.

The procedure and the terms of submission of information in the field of hydrometeorology and environmental monitoring to the Military Forces of the Russian Federation are determined by special agreements between Roshydromet and Military Forces of the Russian Federation on hydrometeorological support of their activities.

The transmission of information in the field of hydrometeorology and environmental monitoring to the global telecommunication network of the World Meteorological Organization from points of the main state observation network included in the WMO international observation network is implemented in accordance with the legislation of the Russian Federation regulating international information exchange and procedures established by the WMO.

If the information in the field of hydrometeorology and environmental pollution monitoring is legally received from Roshydromet organizations and institutions and if the information compiled on its basis is commercially distributed, a reference to the information source is required.

In respect of the observation data of environmental pollution in the Russian seas received by Roshydromet we should note that these data are submitted, apart from World Data Centre, to the State Oceanographic Institute (SOI) which is also a Roshydromet institution[18]. On the basis of the analysis and summary of these data SOI issues "Yearbooks of sea water quality by hydrochemical parameters", displayed at the website of the Institute (http://oceanography.ru/).

The following level of generalization of marine pollution data is revealed in the "Annual Reviews of state of environment and environmental pollution in the Russian Federation" issued by Roshydromet. These reviews are displayed on the website of Institute of Global Climate and Ecology (IGCE) established jointly by the Russian Academy of Sciences and Roshydromet (http://www.igce.ru). Finally, these data form the basis for the annual state report "On the state and protection of the environment of the Russian Federation" issued by the Ministry of Natural Resources

[18] Apart from it observation data of environmental pollution and state of the Caspian Sea are submitted by organization-observers to the Caspian Marine Scientific Research Center - a regional Roshydromet institution.

and Environmental Protection of the RF (http://www.mnr.gov.ru). From time to time wider summary reports are issued such as the report "Trends and dynamics of environmental pollution in the Russian Federation at the turn of 20th-21st centuries" issued by IGCE (and displayed at its website)[19].

As we can see, Roshydromet successfully copes with the notifying function of environmental monitoring, but it is not enough for environmental protection. Monitoring results can't be restricted to reports and reviews, and monitoring should not come to no purpose. The increase of monitoring efficiency is possible due to a wider use of the received data for regulation of anthropogenic load on the environment, and transformation of monitoring from a "thing-in-itself" into a "thing-for-us". To achieve it, mechanisms and implementation procedure of instructive, preventive and controlling functions of environmental monitoring should be developed.

As it has already been mentioned, monitoring of water biological resources and monitoring of subsoil state are implemented in Russian seas alongside with monitoring of water bodies and monitoring of state and pollution of the marine environment. Data received through these types of environmental monitoring are less available for the wide public than the data on marine pollution; they are mostly presented in scientific publications[20]. The exception is the data on fish catches published and regularly updated at the website of the "Centre of monitoring system of fishery and communication" (http://www.cfmc.ru), subordinate to Rosrybolovstvo.

Giving a general description to the state of the information system of environmental monitoring of Russian seas (and other natural objects) we can note that it is like a ship without sails (though the ship is quite well-equipped). There is one "sail" anyway. This is the right of every individual for valid information on the state of environment, as stated in the Russian Constitution. We can say though that the information system of environmental monitoring somehow copes with this task. But this "sail" is not enough for the "ship" to reach the required speed and adhere to the right course. At this point we should remember another important constitutional right - the right of every individual for the favourable environment. To ensure this right, monitoring data should be used not only for informing the individuals, but also for regulating the load on the environment. This "sail" is still missing in our navigation system.

[19] This report in particular presents the data on the reduction of pollutants inflow from the Russian coast of the Caspian Sea which occurred at the turn of the century.

[20] Until recent time the results of monitoring of water biological resources in the Volga-Caspian basin, including the data on fish stock and state of its habitat had been published in fishery research reviews published by FSUE "KaspNIRKh" annually. Unfortunately this practice was ceased in 2006.

1.4. Increasing the efficiency of state environmental monitoring procedure

As it has already been noted, the amendments to the Federal Law "On Environmental Protection" introduced by Federal Law No.331-FZ from 21 November 2011 aimed at increasing efficiency of the state environmental monitoring came into force on 1 January 2012. This section of the book is to give a detailed analysis and characteristics of these changes.

First changes were introduced into the definition of the term "environmental monitoring". The definitions of environmental monitoring in the previous and the current version of the law differ in their content. We will further explain these differences. Let us look into the new definition of the term environmental monitoring, which states that it implies *integrated observations of the state of environment, including natural environment components, natural ecological systems and of ongoing processes, phenomena and assessment and forecasting of changes in the state of the environment.* We should note that this definition is better than the previous one, as it is more specific in respect of monitoring objects.

In the new version of the law environmental monitoring implies only state environmental monitoring. The previous edition of the law covered monitoring in general and considered state monitoring as a type of this general monitoring implemented by federal executive agencies. We give a negative assessment to this innovation, as it disregards the environmental monitoring implemented by resource users (it is more often called industrial, or local or target). Now this monitoring should be referred either to state environmental monitoring (as its implementation at the local level) or to engineering and environmental survey or to industrial environmental control. However neither of these variants can be regarded as successful (see Chapter 2).

In our opinion, it should be advisable to adhere to the general definition of environmental monitoring and single out three categories: 1) federal (national) monitoring, carried out by federal executive agencies; 2) territorial monitoring implemented by constituent entities of the Federation; 3) local monitoring implemented by resource users. First two categories can be joined in state environmental monitoring.

In accordance with the new edition of Article 63 of the Federal Law "On environmental protection", state environmental monitoring is implemented within the framework of the unified system of the state environmental monitoring by federal executive agencies, governmental agencies of the constituent entities of the Russian

Federation within their competence determined by the legislation of the Russian Federation through establishing and supporting of observation networks and information resources within the framework of the unified system of state environmental monitoring and through establishing and use of the state data fund by a federal executive agency authorized by the Government of the Russian Federation.

Thus the new edition of the law gives a new birth to the Unified State System of Environmental Monitoring (USSEM), which establishment was stipulated for in Resolution of the RF Government No. 1229 from 24/11/1993 and Order of the Ministry of Environment Protection and Natural Resources No. 49 from 09/02/1995 (both acts were later called off). We can't but note that the idea looks much better after its re-birth, due to clearer definitions of objectives, tasks, subsystems and their functions.

After going through many trials, the law clearly states that the objective of the state environmental monitoring is to ensure environmental protection (Article 63, item 1). Let us compare this phrase with the one used before: the objective of environmental monitoring is meeting the requirements of the state, legal entities and individuals as regards to valid information needed for prevention and (or) decreasing of negative consequences of environmental changes.

According to the new edition of the Federal Law, the tasks of the unified system of the state environmental monitoring are as follows:

regular observations of the state of the environment, including environment components, natural ecological systems and of processes, phenomena and changes of the state of the environment;

storage, processing (generalizing, classification) of information on the state of environment;

analysis of the received information to timely identify changes in the state of environment under the impact of natural and (or) anthropogenic factors;

provision of state government agencies, local government agencies, legal entities, individual entrepreneurs and individuals with the information on the state of environment.

And another important innovation. The Statute on the USSEM from 1995 (called off) and the Statute on the organization and implementation of the state environmental monitoring from 2003 (still in effect, but likely to be called off or amended) defined monitoring subsystems at by-law level. Now the list of subsystems is given in the Federal Law "On Environmental Protection", according to which (Article 61, item 3), the unified state system of environmental monitoring includes the following subsystems:

state monitoring of the state of environment and environmental pollution;

state monitoring of atmospheric air;
state monitoring of radiation situation in the Russian Federation;
state monitoring of lands;
state monitoring of fauna objects;
state monitoring of forest pathology;
state monitoring of subsoil;
state monitoring of water bodies;
state monitoring of water biological resources;
state monitoring of inland sea water and territorial sea of the Russian Federation;
state monitoring of exclusive economic zone of the Russian Federation;
state monitoring of continental shelf of the Russian Federation;
state monitoring of the unique ecological system of Lake Baikal;
state monitoring of game resources and their habitat.

Having compared this list with the one presented in the Statute on the organization and implementation of the state environmental monitoring from 2003, we can see that the new list is by far longer (we have underlined new monitoring subsystems). The majority of new subsystems emerged as a result of new laws which describe them in detail. For example, monitoring of water biological resources appeared in the list due to the adoption of the Federal Law "On fishery and conservation of water biological resources" adopted in December 2004.

It is quite different from the state monitoring of environment state and pollution, which is the name of monitoring of state of the environment and its pollution in the new edition of the law "On environmental protection".

As we know, until 1 January 2012 legislation of the RF stipulated for two types of state environmental monitoring: 1) *environmental monitoring* in accordance with the law "On environmental protection"; 2) *monitoring of the environment and environmental pollution* in accordance with the law "On hydrometeorological service". This did not bring any benefit, especially taking into account the fact that the effect of the Statute on the organization and implementation of the state environmental monitoring did not cover the monitoring of the environment and environmental pollution.

Finally, legislators managed to overcome this obstacle. First of all, the new edition of the law "On Environmental Protection" modified the definition of *environmental monitoring*, and second, the *monitoring of environment and environmental pollution* in the law "On hydrometeorological service" was renamed into *monitoring of state of the environment and environmental pollution*, and the

latter was included into environmental monitoring concept as a sub-system. That is what legislators can be praised for.

Let us pay our attention to the functions of federal executive agencies participating in the implementation of the state environmental monitoring.

According to Article 63.1, item 4 of the Federal Law "On Environmental Protection", federal executive agencies implementing state management in the field of environmental protection, federal executive agencies authorized to run the subsystems of the unified system of the state environmental monitoring in accordance with the federal laws perform:

search, receipt (collection), storage, processing (summarizing, systematization) and analysis of information on the state of the environment, the ongoing environmental processes phenomena and environmental changes;

search, receipt (collection), storage, processing (summarizing, systematization) and analysis of information on the objects producing negative impact on the environment, the nature, type and scope of such impact;

assessment of the state of the environment and forecasting of its changes under the impact of natural and (or) anthropogenic factors;

determination of relations between the impact of natural and (or) anthropogenic factors on the environment and changes of the state of the environment;

elaboration of offers on prevention of negative impact on the environment and submission of these offers to governmental agencies, local authorities, legal entities and individual entrepreneurs;

submission to governmental agencies authorized to implement state control (oversight) and law-enforcement agencies of information on breaking of environmental standards as a result of the impact of natural and (or) anthropogenic factors and offers aimed at elimination of such violations;

submission to governmental agencies and local authorities of offers to be considered in preparation of territorial planning documents and (or) offers on changes of the mentioned documents to create favourable conditions for human well-being, restrict negative impact of economic or other activity on the environment, ensure the protection and efficient use of natural resources for the benefit of living and future generations;

issue of urgent information on the necessity to reduce negative impact on the environment of natural and (or) anthropogenic factors;

assessment of efficiency of the organized nature conservation activities;

development and exploitation of data bases for information systems in the field of environmental protection;

storage of information on the state of environment, the ongoing processes and

phenomena, environmental changes and submission of this information to governmental agencies, local authorities, legal entities, individual entrepreneurs and individuals.

It should be noted that this list of authorities of federal executive agencies to some extent covers all the functions of environmental monitoring that we have mentioned, including controlling and instructive functions which are referred to for the first time. Though the instructive function is covered superficially (concerning only offers on prevention of negative impact, elimination of violation of environmental standards, accounting for environmental factors in land use planning), things are about to get going. Ideally, the instructive function is a mechanism linking monitoring results with environmental standard-setting.

Things seem to get going in the right direction, but there are still some concerns left. The main concern is that all the USSEM subsystems will be directed exclusively at environmental protection. The fact that the objective of environmental monitoring is environmental protection is right and important, but USSEM subsystems can nevertheless perform other tasks. For example, the task of water bodies monitoring is to support water economy, and the task of monitoring of water biological resources is to support fishery. If the subsystems are to focus on only one task, the USSEM-II is to follow the steps of USSEM-I.

Moreover, USSEM subsystems can become parts of other federal monitoring and information systems, for example the Russian Unified Emergency Response System (RUERS) or the Unified System on Situation in the World Ocean (see section 1.5). So, the subsystem of monitoring of state and pollution of the environment, supervised by Roshydromet, at the same time acts as a functional subsystem of observations, assessment and forecasting of hydrometeorological and heliographic hazards and environmental pollution of the Russian Unified Emergency Response System (SHTORM).

The Statute on SHTORM adopted by Roshydromet Order No. 25 from 04/02/2008 was elaborated in accordance with the Statute on the Russian Unified Emergency Response System, adopted by Resolution of the Government of the Russian Federation from 30 December 2003 No.794 and Resolution of the Government of the Russian Federation from 24 March 1997 No. 334 "On the procedure of collection and exchange of information on protection of population and territories from natural and anthropogenic emergencies in the Russian Federation".

We should note that in accordance with the Statute on SHTORM, it is designed for:

monitoring and overall assessment of the state of environment (!);

identification and forecasting of natural hazards (hydrometeorological and heliographic ones) and extreme environmental pollution (including radioactive pollution);

immediate transmission of urgent information on hydrometeorological hazards and warnings about extreme environmental pollution to governmental agencies, RUERS management agencies and population;

provision of hydrometeorological information for search and rescue and recovery operations in the emergency-hit areas.

Another legislative innovation which came into force on 1 January 2012 is the State Data Fund of State Environmental Monitoring, which is covered in Article 63.2 of the Federal Law "On Environmental Protection". In accordance with this Article, State Data Fund is the federal information system providing data collection, processing and analysis and including:

information contained in data bases of the subsystems of the unified system of the state environmental monitoring;

results of industrial control in the field of environmental protection and state environmental oversight;

data of the state registration of facilities producing a negative impact on the environment.

The establishment and exploitation of the state data fund are implemented in accordance with this Federal Law, legislation of the Russian Federation on information, information technologies and information protection and other normative legal acts of the Russian Federation.

Federal executive agencies authorized to implement state environmental monitoring and governmental agencies of the constituent entities of the Russian Federation participating in the state environmental monitoring are to submit the information received through monitoring activities to the state data fund.

The procedure of creation and exploitation of the state data fund, the list of contained information, the procedure and conditions of its submission and the procedure of information exchange are set by the Government of the Russian Federation.

The information included in the state data fund is to be used by governmental agencies, local authorities, legal entities, individual entrepreneurs and individuals in planning and implementation of economic or other activities.

The information included in the state data fund is submitted to governmental agencies, local authorities, legal entities, individual entrepreneurs and individuals in accordance with the procedure established by the legislation of the Russian

Federation.

The information included in the state data fund and pointing to the threat of emergency situation, including natural hazards, and to the state of the environment within emergency situation zones is to be immediately submitted to the unified emergency response system.

The information included in the state data fund and pointing to the possible harmful impact on the population of the state of the environment and natural components is to be immediately submitted to the federal state agency for sanitary-epidemiological oversight.

The exchange of information within the framework of the unified system of the state environmental monitoring and between the unified system of the state environmental monitoring, the unified emergency response system and agencies authorized to implement federal state sanitary-epidemiological oversight, the submission of this information to governmental agencies, local authorities, legal entities, individual entrepreneurs and individuals is not charged.

On the basis of the information contained in the state data fund, a federal executive agency authorized by the Government of the Russian Federation prepares an annual state report on the state and protection of the environment, which preparation and distribution is set by the Government of the Russian Federation.

Once the law has just come into effect it is difficult to assess the significance of the State Data Fund of the State Environmental Monitoring (SDFEM). We should note the combination of the data of environmental monitoring, industrial environmental control and state register of the facilities producing a negative impact on the environment is a positive solution. But if the SDFEM objectives are restricted to collection and storage of information and its usage to preparation of the state report on the state and protection of the environment, the efforts are of no worth, as the existing agencies can manage these tasks.

If the establishment of the SDFEM facilitates information exchange, data analysis and generalization, this initiative is welcomed. The Unified State Data Fund on the State of Environment and its Pollution (USDF) - SDFEM predecessor (mentioned above) could not completely cope with these tasks. This especially concerns information exchange - the data submitted to the USDF become a top secret even for organizations of Roshydromet, which is responsible for running the data fund. In our opinion, the new data fund will succeed in information communication only in case it acts as an independent institution of the Ministry of Natural Resources and Ecology of the RF having a legal entity status.

There must be much more benefit from SDFEM than it seems at first sight. It can solve one of the burning problems of environmental monitoring and environmental protection. This problem consists in extremely low level of information support of the federation constituent entities by federal executive agencies implementing environmental monitoring. The data of monitoring held within the RF constituent entities are submitted to the federal centre bypassing local authorities or sold to them; territorial observation networks are recommended to satisfy local needs.

Thus the data of environmental monitoring are found in place where there's no need for them except for the local level where they are really needed as nature conservation problems can be solved only at local level. There's another reason for the fact that the systems of environmental monitoring and environmental standard-setting in Russia are not interrelated, bringing no mutual benefit (the benefit of each system separately is much lower).

How can SDFEM help to solve this problem? The answer is to create jointly with executive agencies regional branches of the fund responsible for data collection from SDFEM subsystems operating in the constituent entities of the federation, data analysis and generalization and use for environmental protection.

In accordance with the new definition of environmental monitoring, its objects are the components of natural environment and natural ecological systems. It means that SDFEM is to collect and generalize the data of observations of separate environment components and large natural ecosystems (such as seas). This task may be entrusted to federal executive agencies responsible for running SDFEM subsystems corresponding to certain environment components.

In conclusion we can note that changes introduced to legislation on environmental monitoring are directed at its integration. In our opinion these changes are positive, but let us hope they will not bring too many restrictions. The ideas are good, but they do not determine the ways they are to be implemented, therefore their implementation depends on executors.

We should note that apart from Federal Law "On Environmental Protection", sufficient changes were introduced to Federal Law from 21 November 1995 No.170-FZ "On the use of atomic energy". Control of radiation situation was replaced by monitoring. It was also specified that the state monitoring of radiation situation in the Russian Federation is part of state environmental monitoring and is implemented within the framework of the unified state automated monitoring system of radiation situation in the Russian Federation and its functional subsystems. We paid our attention to this fact as seas, including the Caspian Sea, are sure to be the objects of the state monitoring of radiation situation.

1.5. Integration of subsystems of the state environmental monitoring of marine water areas at federal level

As it has been mentioned, 6 out of 10 types of environmental monitoring stipulated for in the Statute on the organization and implementation of the state environmental monitoring from 2003 refer to the monitoring of marine water areas. 9 out of 14 subsystems of the Unified System of Environmental Monitoring refer to marine monitoring.

Actually only three USSEM subsystems (types of state environmental monitoring) have been operating in seas for decades. These are: monitoring of water biological resources implemented by Rosrybolovstvo, monitoring of state of environment and its pollution implemented by Roshydromet and monitoring of water bodies implemented jointly by Rosvodresursy and Roshydromet.

Though observations of radiation situation, state of subsoil, game resources and their habitat are carried out regularly, they are mainly restricted to coastal area, they are not bound in space, time and parameters and have no long-term programme.

It is quite difficult to determine what is meant by the state monitoring of inland sea water and territorial sea, continental shelf and exclusive economic zone. As it has been mentioned with the reference to the Statute on the state monitoring of water bodies and the Statute on Roshydromet, this monitoring is more likely to mean the monitoring of state of the environment and pollution applied to marine water areas (we offer to call it monitoring of state and pollution of the marine environment).

Now it is advisable to bring the concept of water bodies monitoring in line with the actual situation where this monitoring type can't be considered as an independent type (subsystem) of monitoring. Actually the monitoring of marine water areas is a combination of monitoring types (subsystems) operating in seas. The emergence of USSEM facilitates the solution of this task. The delay in the search of solution can be explained by legislators' laziness. The suggested definitions of monitoring of inland seas water and territorial sea, continental shelf and exclusive economic zone are presented in Table 1.5.

Table 1.5.

The existing and offered definitions of sea water areas monitoring

Type of monitoring of sea water areas	Legislative act	Definition of monitoring	
		Existing	Suggested
State environmental monitoring of the inland sea water and territorial sea	Federal Law No.155-FZ from 31 July 1998 "On inland sea water, territorial sea and adjacent zone", Article 36, Item 1.	State environmental monitoring of inland sea water and territorial sea, which is part of the state environmental monitoring (state ecological monitoring) of the Russian Federation, is a system of regular observations of the state of marine environment and bottom sediments in terms of physical, chemical, hydrobiological and microbiological parameters and the assessment and forecasting of changes under the impact of natural and anthropogenic factors.	State environmental monitoring of inland sea water and territorial sea is a functional combination of subsystems of the Unified State System of Environmental Monitoring implementing regular complex observations of state of marine environment, marine ecosystems and natural resources, the assessment and forecasting of their changes to conserve marine environment and natural resources and support marine activities within the inland sea water and territorial sea of the RF.
State monitoring	Federal Law No.187-	State monitoring of continental shelf , which is part of the unified state system of environmental	State monitoring of continental shelf is a functional combination of subsystems of

of continental shelf	FZ from 30 November 1995, "On continental shelf" Article 33	monitoring of the Russian Federation, is a system of regular observations of the state of environment, including marine environment and bottom sediments, including the parameters of chemical and radioactive pollution, hydrobiological and microbiological parameters and their changes under the impact of natural and anthropogenic factors.	the Unified State System of Environmental Monitoring implementing regular complex observations of state of marine environment, marine ecosystems and natural resources, the assessment and forecasting of their changes to conserve marine environment and natural resources and support marine activities within the continental shelf of the RF.
State monitoring of exclusive economic zone	Federal Law No. 191-FZ from 19 December 1998 "On exclusive economic zone", Article 29, item 1.	State environmental monitoring of exclusive economic zone, which is part of the unified state system of environmental monitoring of the Russian Federation, is a system of regular observations, assessment and forecasting of the state of marine environment and bottom sediments, including observations of the parameters of chemical and radioactive pollution, hydrobiological and microbiological parameters and their changes under the impact of natural and anthropogenic factors.	State monitoring of exclusive economic zone is a functional combination of subsystems of the Unified State System of Environmental Monitoring implementing regular complex observations of state of marine environment, marine ecosystems and natural resources, the assessment and forecasting of their changes to conserve marine environment and natural resources and support marine activities within the exclusive economic zone of the RF.

Is it good when several USSEM subsystems participate in monitoring of the same natural object, for example, the Caspian Sea? In our opinion, it is beneficial when their activities are coordinated and the received data help to make the assessment of the state of the environment more comprehensive, objective and useful for ecologists. To achieve this we can allow (within reasonable limits) duplication of observations and partial inconsistency of the received data.

In this relation we should note that monitoring of water biological resources and monitoring of state and pollution of the environment carried out in seas, duplicate each other to a certain extent. The monitoring of water biological resources includes observations of habitat, including hydrological and hydrochemical parameters, and monitoring of state and pollution of the marine environment includes observations of hydrobiological parameters characterizing not only the quality of the environment, but also the state of the forage stock for water bioresources.

Besides, these two subsystems of marine monitoring need each other as the links between abiotic and biotic parameters of marine ecosystems make it possible on the one hand to determine the reasons for fish stock dynamics (which is a task of monitoring of water biological resources), and on the other hand to determine the consequences of changes of hydrological and hydrochemical regime, the pollution of marine water and bottom sediments (which is a task of monitoring of state and pollution of the marine environment).

Therefore the key word in the suggested definitions of monitoring of marine water areas is combination, which is synonymous to cooperation and integration. It should be noted that here we talk about *functional* combination in contrast to structural combination. It is time to stop the attempts to move the monitoring subsystems from one agency to another. When these attempts refer to multifunctional subsystems, they should be foiled at once.

Actually there are two ways to combine monitoring subsystems: 1) at the level of observation networks; and 2) at the level of information resources. The first way leads to the creation of the unified observations programme and the second - to the unified information system. To our regret, the relations between different executive agencies characteristic of the modern system of state management do not make it possible to develop, adopt and implement a unified interagency programme of monitoring of marine water areas.

The only way left is to combine information resources. And there is a surprise for us. It turns out, that our country is half way ahead due to the establishment of the Unified State System of Information on World Ocean (ESIMO) within the framework of the Federal Target Programme (FTP) "World Ocean".

In accordance with the concept of the FTP "World Ocean" adopted by Decree of the President of the RF No.11 from 17 January 1997 "On Federal Target Programme "World Ocean", ESIMO is to support:

increased efficiency of management of activities to study and use the World Ocean resources and control its state;

submission of real-time information to decision - takers and direct implementation of certain activity types;

establishment of data banks of normative documentation and tools of metrological support;

development of different monitoring types to support the development of the World Ocean and implementation of marine activities;

submission of generalized or special information to solve various problems which do not require real-time access to data;

information exchange among similar systems within the framework of international cooperation.

Main ESIMO functions are as follows:

collection, processing, accumulation and distribution of information on the World Ocean;

long-term guaranteed storage of information and creation of specialized databases;

issuing information products and delivering them to stakeholders;

information support of programmes and projects of research and practical use of seas and oceans;

acting as data centres in international programmes.

According to the Statute on the Unified State System of Information on World Ocean, adopted by Resolution of the RF Government from 29 December 2005 No.836 the Unified State System of Information on World Ocean is an information system designed to supply the marine activities of the Russian Federation with complex information received from information systems of the federal executive agencies and the Russian Academy of Science.

ESIMO contains the data received through observations, measurements and research on the state of the marine environment, natural resources of the World Ocean and anthropogenic facilities in marine water areas, in the Arctic and the Antarctic, on islands and coastal areas, the data on sea transport, commercial fishing, production of mineral resources and other types of marine activity, social - economic

and other information required to study and use the resources of the World Ocean and to control its state.

The functioning of the unified system is supported by integration and efficient use of the following information systems performing collection, processing, accumulation, storage, protection and distribution of information on the situation in the World Ocean:

a) the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters;

b) Ministry of Foreign Affairs of the Russian Federation;

c) Ministry of Defence of the Russian Federation;

d) Federal Security Service of the Russian Federation;

e) Federal Guard Service of the Russian Federation;

f) Ministry of Education and Science of the Russian Federation;

g) Ministry of Natural Resources and Environment of the Russian Federation;

h) Federal Service for Hydrometeorology and Environmental Monitoring;

i) Ministry of Industry and Trade of the Russian Federation;

j) Ministry of Communications and Mass Media of the Russian Federation;

k) Ministry of Transport of the Russian Federation;

l) Ministry of Economic Development of the Russian Federation;

m) Ministry of Energy of the Russian Federation;

n) Federal Space Agency;

o) Federal Agency for Fishery;

p) Russian Academy of Science.

Federal Service for Hydrometeorology and environmental monitoring coordinates the activities on supporting of the functioning of the Unified System.

Federal Service for Hydrometeorology and Environmental Monitoring jointly with stakeholders among federal executive agencies and the Russian Academy of Science forms the interagency committee to solve the tasks and consider the issues of intersectoral importance on functioning of the unified system, determines its competence, appoints the chairperson and the composition of the committee.

To support the functioning of the Unified System, federal executive agencies and the Russian Academy of Science:

appoint organizations - centres of the Unified System, determine their rights and responsibilities connected with supplying of information resources, technological, technical and other tools of information systems for the Unified

System;

upon agreement with the Federal Service for Hydrometeorology and environmental monitoring adopt the regulations and procedure for the activities of the Unified System centres.

The Unified System Centres ensure informational and technological interaction of information systems, integration of information resources, submission of the scheduled information on the situation in the World Ocean to governmental agencies of the Russian Federation, governmental agencies of the constituent entities of the Russian Federation, legal entities and individuals carrying out marine activities and support international exchange of information on the situation in the World Ocean in accordance with the established procedure.

The Unified State System of Information on World Ocean has been operating long and efficiently (http://www.esimo.ru), it continues to develop, improving technologies and adding new information resources, including data of observations held within the framework of marine monitoring. As a unified information platform, it facilitates the development and integration of different monitoring types to ensure the development of the World Ocean and implementation of marine activity.

As we have mentioned above, one of the weak points of the state environmental monitoring is the insufficient attention to the integrated environmental assessment at regional level. Within ESIMO framework, this drawback is eliminated through the establishment of regional modules for separate seas, including the Caspian Sea. In this connection we can refer to such ESIMO information resources on the Caspian Sea as the electronic reference guidebook on the Caspian Sea (http://esimo.oceanography.ru/esp2/index/index/esp_id/2/section_id/9/menu_id/862), the Caspian section of the electronic atlas "Climate of Russian Seas and the World Ocean" (http://data.oceaninfo.info/atlas/Kasp/2_watertemp.html), operative ESIMO module (http://hmc.hydromet.ru/sea/), containing the daily updated actual and prognostic information on all the seas, including the Caspian Sea.

It is important to note that apart from the data on the state and pollution of the marine environment, ESIMO contains data on marine transport, commercial fishing, production of natural resources which can be used for the assessment of anthropogenic load on marine water areas. Thus, ESIMO has the source data for the all-round assessment of the state of the marine environment, though assessment methods and techniques are not covered.

In our opinion, ESIMO should be regarded as a model for the creation of the Unified Information System on the State of Environment of the Russian Federation

(USSE) - a higher level of integration of USSEM subsystems than the state data fund of the state environmental monitoring. Once the changes to the federal law have been introduced, they will soon be followed by a subordinate act regulating the activity of the SDFEM. It would be an asset if the developers clearly visualized the prospect of turning this data fund into USSE. This change will open new opportunities for information support of nature conservation activity, strengthening the links between standard-setting, assessment and monitoring of the environment.

Chapter 2. Environmental monitoring of marine water areas carried out by resource users

2.1. General provisions of organization and implementation of environmental monitoring by resource users

Environmental monitoring implemented by resource users has a weaker legal background than the state environmental monitoring. This is evidenced by different names of this monitoring type in different legal and regulatory acts. So, the "Instructions on environmental feasibility study of economic and other activities", adopted by Order of the MNR of Russia No.539 from 29/12/1995 calls it "industrial environmental monitoring". The "Statute on the state monitoring of state of subsoil" adopted by Order of the MNR of Russia No.433 from 21/05/2001 calls it "object (local) monitoring". The "Statute on implementation of the state monitoring of water bodies" adopted by Resolution of the Government of the Russian Federation No.219 from 10 April 2007 refers to it as"regular observations of water bodies and water protection zones". Resolution of the Government of the Russian Federation No.20 from 19/01/2006 "On engineering surveys for the preparation of project documents, construction and reconstruction of permanent objects" refers to it as "local monitoring of environment components". Resolution of the Government of the Russian Federation No.87 from 16/02/2008 "On the composition of project documentation sections and requirements to their content" calls it "industrial environmental control (monitoring) of changes of ecosystem components in the course of facility construction and exploitation and in case of emergency".

In our opinion this uncertainty is conditioned by both subjective and objective factors. Subjective factors include controversial interests of different agencies and legal incompetence. Objective factors refer to multiple meanings of the environmental monitoring described in the Introduction to this book. While the environmental monitoring implemented by federal executive agencies mainly focuses on notifying and instructive functions, the main functions for the environmental monitoring performed by resource users are diagnostic and controlling functions. The main objectives of this monitoring are to identify environmental consequences of economic activities, to determine their nature and to assess the efficiency of nature conservation activities. These tasks are close to and even coincide with the tasks of

industrial environmental control[21], that is why it is not surprising that they are often mixed.

To our regret, legal and regulatory acts of the RF do not completely determine the range of marine resource users which are obliged to carry out environmental monitoring. These are undoubtedly enterprises conducting search, prospecting and development of oil and gas deposits. In accordance with RD 153-39-031-98 "Rules of water protection from pollution in the course of drilling at marine oil and gas blocks", the organization licensed for regional geological survey of the continental shelf, search, exploration and development of mineral resources organizes environmental monitoring of the marine environment in the drilling area in accordance with the programme endorsed with territorial agencies of nature conservation.

According to GOST R 53241-2008 "Requirements to protection of the marine environment in the course of exploration and development of oil and gas blocks in continental shelf, territorial sea or coastal zone", the organization implementing exploration and development of marine hydrocarbon blocks must participate in the local state monitoring of the used water areas to timely identify negative impact on water quality and the state of water bodies. The combination of industrial environmental control and local monitoring of water bodies is acceptable. The local monitoring of water bodies is part of the state monitoring[22] and is implemented to:

- control the state of a water body;
- assess the impacts resulting from water disposal and removal of sewage water and wastes;
- timely identify unfavourable changes of the aquatic environment and their consequences;
- specify assessment of environmental impacts.

Local monitoring comprises making measurements and sampling outside marine constructions and installations and is to be implemented with account to:

- environmental impact assessment;

[21] In accordance with item 1 of Article 67 of the Federal Law "On Environmental Protection", industrial environmental control is performed to ensure the implementation of activities aimed at environmental protection, efficient use and rehabilitation of natural resources in the course of economic or other activities, and to observe the requirements in the field of environmental protection, set by environmental legislation.

[22] Although the considered national standard was adopted in 2008, it uses the term "local monitoring of water bodies" to denote the monitoring performed by water consumers. The term was used in the "Statute on the state monitoring of water bodies", adopted by Resolution of the RF Government No. 307 from 14/03/1997, which was called off after the adoption of the Water Code in 2006. In our opinion it is not advisable to include the environmental monitoring implemented by economic entities into state environmental monitoring.

- conditions of subsoil usage licenses;
- conditions of decisions and contracts for water consumption.

These two mentioned normative - technical documents give a brief overview of the Industrial Environmental Monitoring (IEM), saying nothing about the procedure of its organization and implementation. To develop such a procedure stated in IEM programme, we should adhere to specific goals and two circumstances which we will cover below.

The first one consists in the fact that observations of the state and pollution of the marine environment in accordance with the Federal Law "On hydrometeorological service" and Resolution of the RF Government No.1216 from 30/12/2011 refer to the activity in the field of hydrometeorology and related fields. In accordance with the "Statute on the procedure of organization, recording and functioning of the agency-level observations network", adopted by Roshydromet Order No.13 from 21/01/2010, the agency-level observations network is organized and functions with account to main principles of hydrometeorological service[23]:

- representativeness of observation points;
- uniformity and compliance of methods of observations, processing and generalizing of observation results;
- ensuring validity of the received results and availability of information to consumers.

Agency-level stationary and mobile observation points operate in compliance with the requirements of normative documents regulating observations, and observations programme should be agreed with Roshydromet or its territorial agency (organization).

It follows that meteorological, hydrological and hydrochemical observations and observations of marine pollution (including hydrobiological parameters) carried out within IEM framework, should be implemented in accordance with the same procedure as similar observations at state observations network, in accordance with GOST 17.1.3.08-82 "Rules of marine water quality control" (see Section 1.3) and Roshydromet's regulatory and procedural documents regulating these observations in river estuaries, coastal areas and the open sea.

The second circumstance to be considered in the development of the procedure of organization and implementation of industrial (local) monitoring is as follows: in

[23] According to this Statute, its requirements apply to all the legal entities and individuals operating in the field of hydrometeorology and related fields.

accordance with Resolution of the RF Government No.20 from 19/01/2006 "On engineering surveys for the preparation of project documents, construction and reconstruction of permanent facilities" this monitoring referred to as "local monitoring of environment components" is included in special types of engineering surveys. In our opinion, there is enough legal ground for organization and implementation of this monitoring to comply with the requirements to engineering surveys.

According to SP 11-102-97 "Engineering-environmental surveys for construction works" this survey and research are implemented in accordance with the established procedure of project and survey works for environmental feasibility study of the planned economic activities. Throughout the period of construction, exploitation and liquidation of construction facilities engineering-environmental research and survey must be continued by means of environmental monitoring of the state of natural and technical systems, the efficiency of nature protection activities and the dynamics of environmental situation.

The mentioned set of regulations states that permanent observations in the course of engineering-environmental survey (local environmental monitoring or monitoring of natural and technical systems) are carried out to identify the spacial and temporal trends of qualitative and quantitative changes of the state of the environment in the area of construction impact.

Permanent environmental observations should include:

- systematic registration and control of parameters of the state of the environment in the places where prospective impact sources are located and in the prospective impact areas;
- forecast of possible changes of the state of environmental components on the basis of the identified trends;
- elaboration of recommendations and offers to reduce and exclude negative impact of construction facilities on the environment;
- control of use and efficiency of the adopted recommendations on normalization of environmental situation.

The best organization of stationary observations (local environmental monitoring) is to include four consecutive stages:

- holding of preliminary examination to identify components of natural environment to be monitored, determination of the system of the observed parameters, measurement of background values;
- designing of continuously operating system of environmental monitoring, its equipment and functional support, organization of interaction with analogous systems

of other agencies;

- carrying out permanent observations to determine the trend of environmental parameters changes;

- tracing and modelling of environmental situation, making up short-term and long-term forecasts and issuing recommendations.

Monitoring programme is developed jointly with authorized territorial nature conservation agencies and other stakeholders and endorsed with territorial executive agencies.

The monitoring programme determines:

- types of monitoring (engineering - geological, hydrogeological and hydrological, monitoring of atmospheric air, soil-geochemical monitoring, phytomonitoring, monitoring of terrestrial and aquatic fauna);

- the list of observed parameters;

- the location of observation points;

- frequency, time and duration of observations;

-normative - technical and metrological support of observations.

Types of monitoring and the list of observed parameters are determined in accordance with the mechanism of anthropogenic impact (physical, chemical, biological) and affected environment components (atmospheric air, subsoil, soils, surface and ground water, vegetation, fauna, terrestrial and aquatic ecosystems in general etc.).

The location of observation points of the permanent network is determined by the content of the tasks to be solved, peculiarities of natural situation controlling routes of pollutants migration, accumulation and ejection.

The observation techniques should meet the requirements of relevant state standards, state and agency-level legal and regulatory and instructive - methodical documents.

Frequency, time and duration of observations are to be determined in accordance with the nature, intensity and duration of impact, conditions of functioning and service life of industrial facilities, characteristics of environmental situation determining the speed of negative impact spreading and its possible consequences.

Permanent observations are to be launched at preproject stages and corrected further on the basis of the received data. The results of permanent observations are to be included in the unified information system (Data bank DB or geo-information system GIS).

Alongside with SP 11-102-97 "Engineering-environmental survey for construction works" there are several normative - technical documents regulating environmental research within the framework of engineering surveys in marine water areas. These are RD 51-01-11-85 "Environmental research in the course of engineering surveys in the continental shelf" and VSN-00-92 "Engineering survey in the continental shelf" Section 5. Engineering-environmental research as part of engineering survey". Though these two documents mainly duplicate each other, we quote some parts of the second document.

Engineering-environmental research is implemented as an integral part of engineering survey in the continental shelf. The composition and scope of research must be sufficient for the comprehensive impact assessment of the designed oil and gas facilities on the environment and to solve the issues of efficient complex nature management and nature protection in the areas of marine oil and gas deposits development.

The materials of engineering-environmental surveys in the areas of oil and gas resources development in the continental shelf must ensure the solution of the following tasks:

- impact assessment of the designed or reconstructed marine oil and gas production complex as a whole;
- description of environmental well-being of the area before the start of operations to develop its oil and gas resources;
- forecasting of possible environmental consequences of all development stages;
- development of nature conservation activities, tools and methods of environmental impact control;
- designing of environmentally-friendly marine oil and gas facilities and technological processes of exploration, facility construction, exploitation and liquidation of marine oil and gas producing complex;
- development of biologically neutral and non-toxic technology of drilling, production, collection, preparation and transportation of oil and gas under specific natural conditions of the survey area;
- control of long-term changes of background characteristics of the natural environment in the operations area at all stages of oil and gas resources development;
- identification of prospective mariculture species to receive biological products and create the systems of biological post-treatment of sewage waters of marine oil and gas production industry.

The project (programme) of engineering-environmental research, alongside

with meeting general requirements to programme content, should contain:

- methods of observations and measurements, methods and tools of sampling, requirements to precision of measurements and calculations;

- required frequency of water and soil sampling and precision in the determination of vessel location while sampling and carrying out observations and measurements.

Engineering-environmental survey includes:

- microbiological and hydrobiological research, including the study of plankton, benthos and neuston;

- ichthyological research of environmental characteristics and commercial value of the fish in the area;

- ornithological research of biological characteristics of migration and number of birds in the area;

- theriological research of number, habitat, commercial importance and ecology of mammals in the area under study;

- environmental landscape and geobotanic research of the adjacent coastal sites which can be affected by marine oil and gas operations;

- hydrochemical research of background characteristics of natural environment of the area supposedly affected by oil and gas fields development, including the identification of pollutants in marine bottom sediments and determining of main hydrochemical parameters of plants and animals habitats;

The engineering-environmental research in the shelf areas where coastal sites are used or expected to be used for curative or recreational purposes should take into account the identification of possible impact of marine oil and gas blocks development on these types of nature management.

Requirements to microbiological research.

Microbiological research must ensure the receipt of background data on taxonomic composition of dominating groups of bacterial neuston and their main quantitative characteristics:

- total number, kl/cm^3;

- total biomass, mg/dm^3;

- number and biomass of dominating, phenol-oxidizing and oil-oxidizing organisms.

The data on number and biomass must contain average and extreme parameters and their statistical assessment and the limits of seasonal changes observed in the course of surveys of the area.

Samples for microbiological research should be taken jointly with

hydrobiological and hydrochemical operations on one vessel to ensure that samples are taken at the same time and receive comparable results on micro-organisms habitat and abundance.

The average number of samples in the impact area should be at least 2 per 1 square km. The error in determination of sample location should not exceed 100 m.

Requirements to hydrobiological and ichthyological research.

Hydrobiological research should contain:

- general quantitative parameters of plankton, benthos and neuston;
- species composition of dominating organisms;
-spacial distribution of benthic communities;
- main productional characteristics of phytoplankton and phytobenthos;
- range of seasonal changes of quantitative parameters;
- data on the presence and location of mariculture farms in the development area and adjacent sites.

Plankton is characterized by the following parameters:

- species composition of dominating phytoplankton organisms;
- total quantitative indicator of phytoplankton as a whole and indicators of its main species populations (abundance - kl/dm^3, biomass - g/m^3);
- main productional characteristics of phytoplankton (concentrations of a, b, c chlorophyll, the content of pheophytin "a", the intensity of photosynthesis and destruction of organic matter (mean and maximum values, mg O_2/day);
- general quantitative characteristics of all the zooplankton and qualitative characteristics of its main species (abundance in individuals/ m^3, biomass in mg/m^3).

Benthos is characterized by the following indicators:

- species composition of masses of macrophytobenthos, composing the basis of bottom vegetation of the area;
- total projective cover of bottom vegetation within the photic zone (percentage of the total area in the considered benthal);
- the species composition of dominating macrozoobenthos in the area of research;
-the list of main bottom communities indicating species dominating in number and biomass for each community;
- total average biomass in g/m^2, and total average number of macrozoobenthos in individuals/m^2 for every selected community with statistical assessment of mean values;
- biomass and number of main dominating species (mean values and their

statistical estimate);

- the list of commercial benthos species prospective for breeding and their mean and maximum quantitative parameters and the total stock for the area;

- characteristics of the benthos of the area as foraging stock for fish (stock and efficiency).

Benthos samples are to be taken in all the seasons of the year. Samples number can reach 10 for 1 km^2. Error of sample location should not exceed 15 m.

Neuston is characterized by the following indicators:

- species composition of main groups (protozoa, rotifera, larvae of benthic animals, copepoda).

- biomass and number of dominating groups of organisms in mg/m^2 and $individuals/m^2$.

Ichthyological research is to include:

- the collection of data on ichthyoneuston (spawn, fish larvae);

-identification of spawning grounds and grounds suitable for establishment of artificial spawning grounds in development areas and adjacent areas);

- identification of species composition of permanent and migratory fishes;

- quantitative characteristics of fishing in the area and the reasons of their changes throughout the period under study;

- identification of composition of commercial species and its changes throughout the documented period of fishing;

- making up a list of valuable commercial fish species and rare fish species in the areas;

- identification of fish species for breeding;

- determination of sites and location peculiarities of fish breeding farms;

Specialized ichthyological research and field studies should include:

- examination of the coastline for dead fish and determination of reasons of its death (if possible);

- the analysis of fish from test fishing for the content of heavy metals, chlororganic substances, the presence of exo- and endoparasites, the presence of oil in gills and stomachs.

Requirements to ornithological and theriological research

Ornithological research should comprise:

- identification of the full species composition of birds occurring in the area of expected impact, sorting them into migratory, passage and resident species, and selecting of commercial, rare and protected species;

- brief ecological overview of each species of the avifauna of the area, indicating prey items, stays in the area, breeding period, fertility, average numbers and long-term dynamics;

- occurrence and location of mass bird accumulations (breeding colonies, rookeries, feeding grounds etc.), migration routes and other periodic migrations.

Theriological research should include:

Identification of the full species composition of mammals occurring in the area, sorting them into migratory and resident species, and indicating their commercial value and protected species;

Brief ecological overview of each species of the sea mammals, indicating prey items, breeding period and fertility aspects;

Determination of commercial value of the mammals in the area under study, the scope of hunting and its long-term dynamics;

Identification and mapping of breeding grounds and migration routes of sea mammals and approximate estimate of their numbers and their seasonal and long-term changes.

The number of observations should be sufficient to mark migration routes of birds and mammals, their accumulation sites, scope of hunting etc. on the map scaled 1:50000 – 1:100000.

Requirements to hydrochemical observations

Hydrochemical data should give a complete description of the state of marine ecosystems in the expected impact area, including indicators of water pollution in the units of valid maximum permissible concentrations (MPC). The recommended list of hydrochemical parameters determined in the course of environmental survey in the shelf is presented in Annex 4.

Methods of collection and analysis of water samples, ways of their storage and transportation and techniques of results processing must comply with the normative documents and methodical guidelines on the analysis of marine facilities.

In the conclusion of this section we would like to draw readers' attention to the fact that industrial (local) monitoring of marine water areas should be considered as both operations in the field of hydrometeorology and special engineering survey. In both cases the executors of works should have title documents. In the first case it is the license issued by Roshydromet, and in the second case it is a permit registered by self-regulated organizations (SRO). To be more precise, before 2006 when industrial (local) monitoring was started to be considered as a type of engineering survey, it was

enough to have a Roshydromet license to implement it. In consecutive years a SRO permit was required alongside with the licence. Starting from 2012 one permit is enough (see Reference 16).

2.2. Recommendations for organization and implementation of environmental research (environmental monitoring) in the areas of search, exploration and development of oil and gas deposits in the Russian sector of the Caspian Sea

Complex environmental research aiming at environmental survey of oil and gas production in the water area of the Caspian, adjacent to the Russian territory, began in 1997. In several years when the first well was drilled in the Russian subsoil sector,"Programme of industrial environmental monitoring of "LUKOIL" Ltd." for the northern part of the Caspian Sea elaborated under our supervision and still in effect was adopted. Later other companies operating in the Russian shelf of the Caspian adopted similar programmes developed by our Centre.

In this book we would like to acquaint the reader with the recommendations for organization and implementation of environmental research (environmental monitoring) in the areas of search, exploration and development of oil and gas deposits in the Russian sector of the Caspian Sea. We elaborated these recommendations on the basis of the existing legal-regulatory and normative-technical background described in the previous section and taking into account the experience of complex environmental research and environmental monitoring.

It should be noted that these recommendations were elaborated as an integral part of "Environmental protection requirements in the search, prospecting and extraction of mineral resources in the Russian subsoil sector of the Caspian Sea". This document was prepared to replace "Special environmental and fishery requirements for geological study, prospecting and production of hydrocarbon resources in the protected area in the northern part of the Caspian Sea" adopted by order of the Ministry of Natural Resources of the RF No. 211 from 16/09/1998, which were later called off. It is planned not only to extend the special requirements and to bring them in compliance with the legislation in effect, but to spread their effect over the whole Russian subsoil sector of the Caspian Sea. However it is not clear when these plans will be implemented.

It is important to note that all the variants of "Special environmental and fishery requirements..." (adopted in 1998 and in the following temporary and/or local variants) paid great attention to environmental monitoring. So, the special

requirements issued in 1998 stated that "monitoring of natural environment and wildlife state and assessment of efficiency of nature conservation activities must be implemented at all the stages of prospecting, development and exploitation of marine deposits". Consequently, these requirements, however implemented, are another document (in addition to those mentioned in the previous section), obliging oil and gas companies to implement environmental monitoring in the Caspian Sea areas allotted for search, prospecting and development of hydrocarbon resources.

Further we present our recommendations, numbered for the convenience of the reader:

1. Subsoil user (Customer) is responsible for the collection of information to ensure environmental protection in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea. To do it, Subsoil User organizes general and special engineering - environmental survey involving planning and surveying and research organizations (Executors), responsible for the actuality, completeness and validity of information submitted to the Customer.

The structure of engineering-environmental survey in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea is presented at Fig. 2.1.

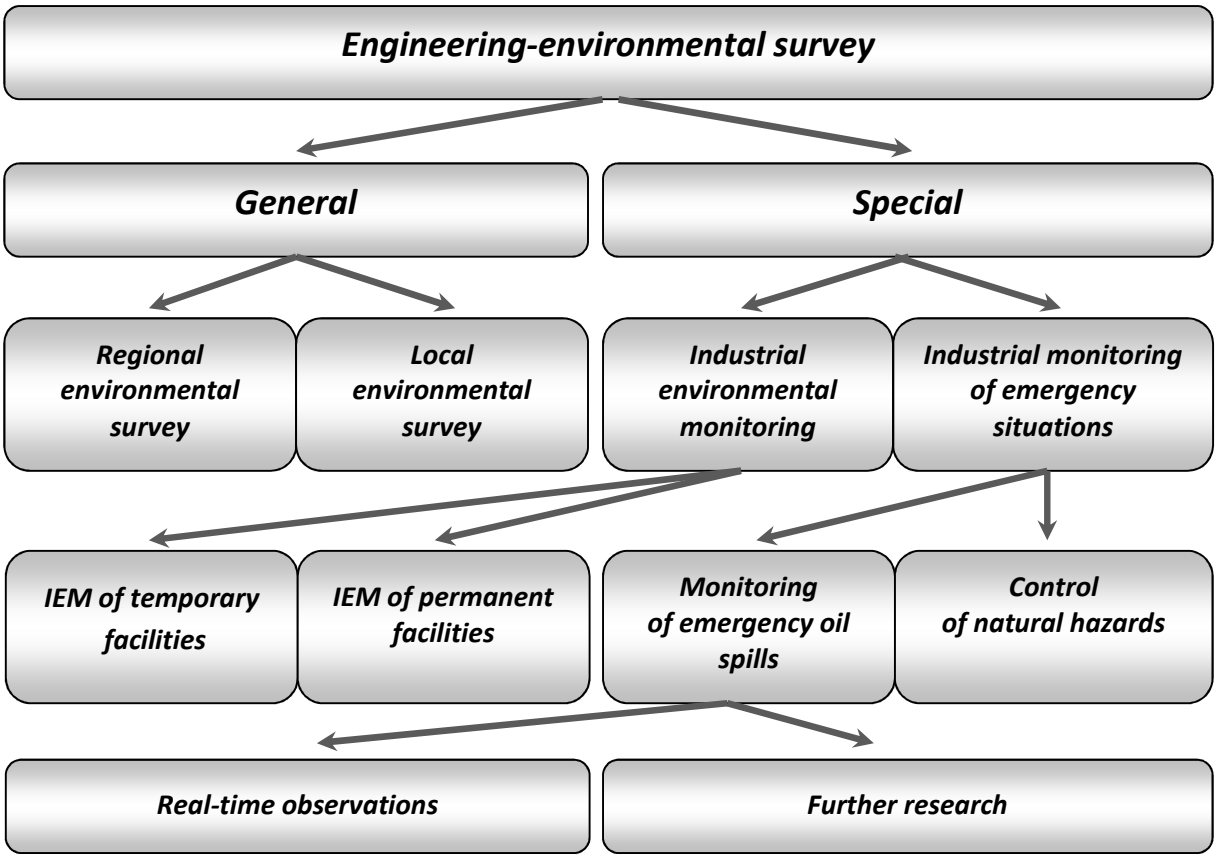


Fig 2.1. The content of engineering-environmental survey in the course of search, prospecting and development of mineral resources of the Russian subsoil and bottom sector of the Caspian Sea.

2. The task of *general* engineering-environmental survey (further referred to as environmental survey) is to collect information for environmental feasibility study of the planned activities. To collect information used in the *Environmental Impact Assessment (EIA), regional environmental survey is organized.* To collect information *used for the elaboration of nature conservation activities* (sections "List of activities on environmental protection"(LAEP) or "Protection of subsoil and the environment" of the project documentation) *local environmental survey* is organized and implemented.

3. Regional environmental survey aimed at the assessment of environmental situation and anthropogenic load on the environment in the area of planned activities must cover the whole water area site allotted for subsoil-related operations (hereinafter referred to as license area). As subsoil usage is a multi-stage process involving launching of new facilities and operations subject to environmental feasibility study, regional environmental survey must be implemented throughout the whole period of effect of the license for subsoil use.

4. Regional environmental survey taking into account geo-ecological characteristics of the Russian subsoil sector of the Caspian Sea must be carried out at least 2 times a year in different seasons. Ship stations are evenly distributed within the license area so that the total number of stations should be at least 25, but not exceeding 50 (the recommended list of environmental parameters determined in the course of regional environmental survey is presented in table 2.1).

5. The report on regional environmental survey submitted by Executor to the Customer after the annual operations contains "Overview of the state of the environment at the license area" including sections describing the state of:

a) natural environment, including meteorological, hydrological, hydrochemical, sedimentological and hydrobiological conditions and ichthyo-, avi- and theriofauna;

b) anthropogenic load, including marine environment pollution (marine water and sediments) and water bioresources (catches and stock) and the factors affecting their state.

6. Current data in the overview of the state of the environment are compared with the data of previous years, which are reference and fund data for the first stage of the regional survey (for the first three years). Additional source of the information on the state of the environment in the course of regional environmental survey is the

satellite observations data of the sea surface, characterizing changes of water temperature, concentration of suspended matter and chlorophyll and the presence and the area of oil film.

7. When the license area partly coincides with the specially used area, a special section of the overview is devoted to the description of the state of the environment in the shared water area. Overview of the state of the environment for the previous year is used to prepare the *results of environmental impact assessment* within the projects developed throughout the period starting in April of the current year to March of the following year. Materials of regional environmental surveys can be used for the elaboration of nature conservation activities within technical projects (when there's not enough materials of the local environmental research).

8. The main task of the local environmental survey is the collection of information to elaborate nature conservation activities within *construction projects* (including those for the regulation of environmental impact, assessment and compensation for damages). Materials of local environmental survey must be also used for the development of nature conservation activities within *technical projects*, if they are to be implemented in the areas where local environmental survey is held for at least 2 years.

9. Local environmental survey is held at the same time with regional environmental survey (at least 2 times a year in different seasons) at the fine grid of stations in the areas where prospective deposits (PD) of mineral resources are discovered. Local environmental survey starts alongside with prospecting geology operations aimed at estimation of reserves (C2) and finishes as the operations to prepare deposits for commercial development are completed (transfer of reserves from C2 to C1 category).

10. In the course of local environmental survey ship stations are evenly distributed within the water area designing 1 station for 10 km^2, so that the total number of stations should be at least 20, but not exceeding 30. If the pipeline laying is planned, the stations are located at cross sections evenly distributed along the expected route. The central station is located on the pipeline route , and the remaining four stations are located to the right and to the left in the distance of 1 km and 2.5 km. There should be at least 1 cross section per 10 km of the pipeline route. (The recommended list of environmental parameters determined in the course of local environmental survey is presented in table 2.1).

Table 2.1

The list of environmental parameters controlled in the course of environmental survey and environmental monitoring in the areas of search, prospecting and production of hydrocarbons

Type of survey (observations)	**Regional and local environmental survey**	**Industrial environmental monitoring of temporary and permanent constructions and areas of geology prospecting operations**
Meteorological	Atmospheric pressure, air temperature and humidity, wind speed and direction, cloudiness visibility, weather phenomena At every station	
Hydrological	Wave height, period, type and direction, transparency, colour, water temperature and electric conductivity (salinity). At every station (water temperature and electric conductivity are measured with help of a probe, fixing measurements every 1 meter).	
Sedimentological	Granulometric composition, organic carbon At every station	Granulometric composition, ignition loss. At every station
Hydrochemical	pH value,concentration of dissolved carbon (organic and inorganic), oxygen and hydrogen sulfide, biological oxygen demand (BOD_5), ammonium, nitrate and total nitrogen, mineral and total phosphor, dissolved silicon and suspended matter. At every station, surface and near-bottom layers	pH value,concentrations of dissolved oxygen and hydrogen sulfide, biological oxygen demand (BOD_5), ammonium, nitrate and total nitrogen, mineral and total phosphor, dissolved silicon and suspended matter. At every station, surface and near-bottom layers

Continuation of table 2.1.

Study of marine water pollution	Concentration of oil products, synthetic surfactants, phenols, heavy metals (iron, manganese, zinc, nickel, copper, lead, cadmium, cobalt, mercury, barium); aliphatic and acyclic hydrocarbons (from C_{14} to C_{33}); polycyclic aromatic hydrocarbons (naphthalene, methyl-naphthalene, dimethyl-naphthalene, biphenyl, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benz(b)-fluoranthene, benz(k)-fluoranthene, benz(a)pyrene, dibenz(a,n)anthracene, benz(g,h,i)perylene); persistent chlororganic compounds (polychlorinated biphenyl, pecticides of HCCH and DDT groups). At every station, surface and near-bottom layers	Concentration of oil products, synthetic surfactants, phenols, heavy metals (iron, manganese, zinc, nickel, copper, lead, cadmium, cobalt, mercury, barium); aliphatic and acyclic hydrocarbons (from C_{14} to C_{33}); polycyclic aromatic hydrocarbons (naphthalene, methyl-naphthalene, dimethyl-naphthalene, biphenyl, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benz(b)-fluoranthene, benz(k)-fluoranthene, benz(a)pyrene, dibenz(a,n)anthracene, benz(g,h,i)perylene). At every station, surface and near-bottom layers
Study of pollution of the surface layer of bottom sediments.	Concentration of oil products, synthetic surfactants, phenols, heavy metals (iron, manganese, zinc, nickel, copper, lead, cadmium, cobalt, mercury, barium); aliphatic and acyclic hydrocarbons (from C_{14} to C_{33}); polycyclic aromatic hydrocarbons (naphthalene, methyl-naphthalene, dimethyl-	Concentration of oil products, synthetic surfactants, phenols, heavy metals (iron, manganese, zinc, nickel, copper, lead, cadmium, cobalt, mercury, barium); polycyclic aromatic hydrocarbons (naphthalene, methyl-naphthalene, dimethyl-naphthalene, biphenyl,

	naphthalene, biphenyl, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benz(b)-fluoranthene, benz(k)-fluoranthene, benz(a)pyrene, dibenz(a,n)anthracene, benz(g,h,i)perylene). At every station	acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benz(b)-fluoranthene, benz(k)-fluoranthene, benz(a)pyrene, dibenz(a,n)anthracene, benz(g,h,i)perylene). At every station

Continuation of table 2.1.

Microbiological	Total number and biomass of micro-organisms, the abundance of saprophyte microflora and oil-oxidizing bacteria in marine water. At every station in the surface layer	Not carried out
Hydrobiological	Species composition, number and biomass of neuston, phytoplankton, zooplankton and zoobenthos. Concentration of phyto-pigments, plankton production and destruction. At every station (concentrations of phyto-pigments, production and destruction are determined in water samples taken in the surface layer).	Species composition, number and biomass of phytoplankton, zooplankton and zoobenthos. Concentration of phyto-pigments At every station (concentration of phyto-pigments is determined in water samples taken in the surface layer).
Ichthyological and theriological	Species, age, sex and size composition, number and biomass, fish nutritional state, number of Caspian	Not carried out

	seal. Regional environmental survey includes determination of content of heavy metals and oil products in gills, liver and muscles of main commercial species. Local environmental survey determines the content of heavy metals and oil products only in the muscles of goby fishes. The scope of ichthyological and theriological research is determined in the terms of reference.	
Ornithological	Species composition and number of birds (classifying them into resident, passage and migratory birds), mass accumulation sites (breeding colonies, feeding grounds etc.), migration routes.	Not carried out

11. In accordance with town-planning legislation of the Russian Federation, the report on engineering-environmental survey (local environmental survey) is submitted for the state (town-planning) expertise alongside with the project documentation. The report must contain source materials required for the elaboration of Environmental protection monitoring programme as part of project documentation, including the data on background concentration of pollutants in marine water and in the surface layer of bottom sediments, the data on identified pollution sources, including secondary pollution foci and the data on species composition, number and biomass of hydrocoles, the stock of commercial fish species, the number of rare protected animals and plants, assimilation capacity and biological productivity of the water area.

12. The ways for using the materials of general engineering-environmental survey (regional and local environmental survey) for the preparation of different projects of search, prospecting and production of mineral resources in the Russian subsoil sector of the Caspian are listed in Table 2.2.

Table 2.2

The use of materials of general engineering-environmental survey (environmental survey) for the preparation of projects of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea

<table>
<tr><th>Name of project documentation section</th><th>Technical projects (projects of technical facilities and operations)</th><th>Construction projects (projects of construction facilities and operations)</th></tr>
<tr><td>Results of environmental impact assessment</td><td colspan="2">Materials of regional environmental survey</td></tr>
<tr><td>Environmental protection *</td><td>Materials of local and/or regional environmental survey</td><td>Materials of local environmental survey**</td></tr>
</table>

Note: * the section "The list of environmental protection activities" in the projects of *permanent structures and operations* and the section "Protection of subsoil and the environment" in the project of *temporary construction and operations*, ** report on the engineering-environmental survey (local environmental

survey) is submitted for state (town-planning) expertise with project documentation.

13. The objective of *special* engineering-environmental survey (local monitoring of environment components) is the analysis of environmental consequences of economic and other activity, the assessment of efficiency of nature conservation activities to minimize the negative impact of these activities on the environment. Special engineering-environmental survey is subdivided into *industrial environmental monitoring* and *emergency environmental monitoring*.

14. Industrial environmental monitoring is a system of environmental observations in the area of industrial facilities location and the assessment of environmental changes under the impact of industrial activity and other anthropogenic and natural factors. Industrial environmental monitoring (IEM) implemented in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea is subdivided into monitoring of *engineering structures and operations* and monitoring of *permanent structures and operations*.

15. Industrial environmental monitoring of *engineering structures and operations* is implemented in 3 stages:

1) before the start of operations (facility construction);

2) in the course of operations (facility exploitation);

3) after the operations completion (facility disassembly).

At the first and the third stages of the monitoring observations are held once only, at the second stage- once a month throughout the whole period of operations (facility exploitation).

16. In the course of *monitoring of operations locales* (including seismology prospecting and other types of geological and geophysical operations), IEM stations which number should be at least 25, are evenly distributed in the water area where operations are carried out.

At the first and the third stage of *monitoring of facilities location areas* IEM stations which total number is 25 are located:

a) one station- in the centre of the polygon (location spot of the temporary facility);

b) in groups of four stations - at the distance of 100 m and 200 m from the polygon centre;

c) in groups of eight stations - at the distance of 500 m and 1,000 m for 8 compass points.

16 IEM stations operate at the second stage. They comprise the

abovementioned stations with the exception of those located in the centre of the polygon and at the distance of 100 m and 200m from it (the recommended list of IEM-measured parameters of marine environment pollution and hydrobiological parameters as well as the list of accompanying observations are presented in table 2.1) Project implementation permit received by the Customer is at the same time a permit to implement IEM, which is an integral part of industrial activities.

17. The Customer organizes the industrial environmental monitoring of engineering facilities and operations so that at least one of observations stages coincides with the regional environmental survey.

The industrial environmental monitoring can comprise special research aimed at the assessment of impact of any activity (e.g. seismology prospecting) on the marine environment and biota. The special research is to specify the list of environmental parameters measured within IEM implemented throughout this type of activities.

Additions to the IEM concerning the peculiarities of planned operations related to the use of subsoil and/or natural conditions of the area can be included in the section "Protection of subsoil and the environment" within project documentation before it is submitted for the state environmental expertise.

18. The report on the IEM submitted to the Customer by the Executor on completion of the survey must contain the "Reference on environmental situation in the area of operations", including:

a)brief description of the implemented survey;

b) description of nature and assessment of scale of environmental consequences of industrial activities identified through the analysis of spacial - temporal variability of the marine environment parameters;

c) assessment of efficiency of nature conservation activities on the basis of comparative analysis of the nature and scale of expected (within EIA) and actual environmental consequences.

At the same time, the Executor submits this Reference to executive agencies implementing state environmental control in the Russian subsoil sector of the Caspian Sea and other organizations, which list and addresses should be indicated in the IEM Terms of Reference of the Customer.

19. Industrial environmental monitoring of permanent facilities and operations is held throughout the lifetime of the facilities, from construction start to liquidation end or transfer for other use, not related to the search, prospecting and development of mineral resources. Throughout the whole time period field research is combined with satellite observations of the state and pollution of marine surface in the

operations area.

20. Field research within IEM of permanent structures and operations is carried out once a season except for winter if the ice covers the research area. The following stations (20 altogether) are located around point objects of IEM station:

a) four stations - at the distance of 500 m from the polygon centre at 4 compass points;

b) in groups of eight stations - at the distance of 750m and 1,000 m at 8 compass points.

Around linear objects (pipelines) IEM stations are located at the cross-sections set in the course of local environmental survey - in groups of 4 stations for each cross-section on both sides of the route in the distance of 200 and 500 metres from it (the recommended list of IEM-measured parameters of marine environment pollution and hydrobiological parameters as well as the list of accompanying observations are presented in Chapter 5 of this programme).

21. Additions to the IEM of permanent facilities and operations concerning the peculiarities of planned operations related to the use of subsoil and/or natural conditions of the area can be included in the section "List of activities on environmental protection" (LAEP) within project documentation before it is submitted for the state environmental expertise. Project implementation permit received by the Customer is at the same time a permit to implement IEM, which is an integral part of industrial activities.

22. The report on IEM of permanent facilities and operations, submitted to the Customer by the Executor upon the completion of the annual survey cycle, which usually coincides with the calendar year, is to include the "Report on environmental situation in the deposit area", containing:

a) brief description of the implemented survey;

b) description of nature and assessment of scale of environmental consequences of industrial activities identified through the analysis of spacial - temporal variability of the marine environment parameters;

c) assessment of efficiency of nature conservation activities on the basis of comparative analysis of the nature and scale of expected (within EIA) and actual environmental consequences.

At the same time, the Executor submits this Report to executive agencies implementing state environmental control in the Russian subsoil sector of the Caspian Sea and other organizations, which list and addresses should be indicated in the IEM Terms of Reference of the Customer.

22. Main peculiarities of organization of observations and submission of the

results of industrial environmental monitoring in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea are presented in Table 2.3.

23. Environmental monitoring of emergency situations implemented in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea includes the control of hazardous meteorological, hydrological and geological processes, capable to cause emergency situations and monitoring of emergency oil spills.

24. The control of hazardous meteorological processes is implemented through organization and implementation of meteorological observations at engineering and permanent facilities, where an automated meteorological station is installed. The station outputs the information on the start and end of hazardous hydrometeorological phenomenon or process which parameters exceed the limits set by safety instruction for a certain type of operations.

Table 2.3

Organization of observations and submission of the results of industrial environmental monitoring in the course of search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea

Aspects of industrial environmental monitoring	**Technical projects (projects of technical facilities and operations)**	**Construction projects (projects of permanent facilities and operations)**
Organization of observations	Observations are carried out in 3 stages: 1) before the start of operations; 2) in the course of operations; 3) after the completion of operations. Observations at the 1st and 3rd stages are carried out only once, while observations at the 2nd stage are carried out once a month throughout the whole period of operations.	Observations are held once a season (excluding winter if the sea is covered with ice) throughout the whole lifetime (construction, exploitation and liquidation) of the facilities.

Type of submission of monitoring results	IEM Report "Reference on environmental situation in the operations area"	IEM Report "Report on environmental situation in the operations area"

25. Besides, the data of meteorological observations are used for meteorological support of air flights and are submitted to organizations providing hydrometeorological support of industrial facilities and implementing industrial environmental monitoring which use these data for the assessment of meteorological situation in the operations area. Therefore the automated meteorological station must be equipped with sensors of air temperature and humidity, wind speed and direction, atmospheric pressure, precipitations, visibility and cloud height.

26. The control of hazardous hydrological processes is implemented through organization and implementation of hydrological observations at *permanent facilities*. For this purpose automated bottom hydrological station is installed and connected to the facilities. This station outputs the information on and has a warning system of the start and end of hazardous hydrological phenomenon or process, which parameters exceed the limits set by the instruction of safety requirements for a certain type of operations.

27. The data on hydrological observations are submitted to the organization implementing industrial environmental monitoring and using them for the assessment of hydrological situation in the operations area. In this connection the automated hydrological station must be equipped with sensors of waves and sea level, ice cover thickness, current speed and direction, water temperature and electric conductivity.

28. The control of hazardous geological processes is implemented through organization and implementation of seismological observations at *permanent facilities*. For this purpose automated bottom seismic stations equipped with highly sensitive sensors are installed and connected to the facilities. This stations output the information on and has a warning system of the start and end of hazardous geological phenomenon or process, which parameters exceed the limits set by the instruction of safety requirements for a certain type of operations.

29. Control of hazardous engineering-geological processes is implemented through underwater examination of locations of temporary facilities after they are liquidated (disassembled) and permanent facilities throughout the whole period of their exploitation at least once a year. Underwater examination is implemented with

help of divers and/or controlled underwater vehicles to identify and document (by underwater filming) local anthropogenic anomalies - indicators of hazardous engineering-geological processes (soil subsidence and erosion, gas emissions, changes in chemical composition of near-bottom and silt water, state of periphyton, phyto- and zoobenthos etc.).

30. Monitoring of emergency oil spills includes the environmental survey of the polluted area which must start no later than 24 hours after the spill occurred. The survey completes after the average level of oil pollution of the surface layer of bottom sediments reduces to mean values registered before the oil spill according to the data of regional environmental research.

31. Environmental survey in the polluted area is subdivided into real-time observations and follow-up research. Real-time observations are performed during the oil spill (from the start to the end of emergency oil spill to marine environment) to specify its parameters, determine the scope and level of impact on the marine environment. Before the conditions specified in item 30 are observed, follow-up research is implemented to identify and assess environmental consequences of the emergency oil spill.

32. Real-time observations include aviation, satellite and ship observations. First of all (no later than 24 hours since the spill occurs), aviation survey is carried out, which is further performed every day at day-time. Air observation results in maps of the polluted water area indicating the location, size, area and thickness of the oil film and its drifting routes. The data of air observations are specified and completed using satellite information. Real-time ship observations should start no later than 3 days after the spill occurs. Ship stations (ranging from 5 to 10) are located along the oil drifting route. The results of ship observations are presented as analysis protocols, containing the data on fraction composition of the oil (film, dissolved, suspended, deposited), chemical composition of the dissolved and deposited fractions (light, aliphatic, polycyclic aromatic hydrocarbons). The results of real-time observations are used for information support of operations aimed at liquidation of emergency oil spills.

33. Follow-up research includes field survey and satellite observations. Field survey (1st stage) must start no later than 10 days after the spill stops. The stations are evenly distributed in the polluted water area so that the total number of stations should not be less than 25 (in case of a local spill) and not more than 50 (in case of regional and federal level spill). The list of parameters measured in the course of follow-up field surveys is similar to that of regional environmental survey. Starting from the 2nd stage to the very end follow-up field survey is carried out

simultaneously with regional environmental survey in accordance with stations scheme adopted at the 1st stage. Throughout the whole period of field survey (from the first stage to the last) satellite observations are carried out. Their task is to identify the foci of secondary pollution of the water area.

34. The report on follow-up field survey, submitted by the Executor to the Customer upon completion of every stage must contain the "Report on environmental consequences of the emergency oil spill" including:

a) brief description of the implemented survey;

b) characteristics of qualitative and quantitative changes in the state of marine environment

c) approximate estimation of damages to the environment and water bioresources and the assessment of efficiency of measures taken for their conservation. At the same time, the Executor submits this Reference to executive agencies implementing state environmental control in the Russian subsoil sector of the Caspian Sea and other organizations, which list and addresses should be indicated in the Terms of Reference of the Customer for the implementation of follow-up field survey.

35. Upon the completion of follow-up research, within a 6-months period the Customer (independently or with help of contractor organizations) prepares the "Overview of environmental consequences of emergency oil spills and the ways of environment rehabilitation", containing:

a) the description of the oil spill, liquidation operations and implemented survey;

b) the assessment of environmental changes caused by the oil spill from the point of their environmental, economic and social importance;

c) specified estimation of damages to the environment and water bioresources;

d) scientific grounds for measures aimed at the environment rehabilitation in the polluted area. The Customer then submits this Overview to the executive agencies implementing state control in the Russian subsoil sector of the Caspian Sea and the state authorities of the Caspian littoral constituent entities of the Federation.

36. Satellite observations as part of the engineering-environmental survey (research and monitoring) are organized and implemented by specialized contractor organizations performing the receipt, deciphering and GIS analysis of satellite data in accordance with the Customer's Terms of Reference, which are to stipulate for the receipt of satellite data on water surface temperature, concentration of chlorophyll and suspended matter and on the area of the oil film.

37. Measurement tools and methods used in the course of engineering-

environmental survey must meet metrological requirements set by regulatory legal acts of the Russian Federation on ensuring of measurements uniformity (measurement methods must be certified, measurement tools must be included in the state register of measurement tools). Special requirements to the use of measurement tools must be observed and test laboratories should be certified to carry out relevant measurements. Measurement results must be expressed in the units acceptable in the Russian Federation.

38. In case strong or extreme environmental pollution and/or natural or anthropogenic emergency occur, the Executor immediately reports to the Customer. The Customer having received this information or having identified these phenomena independently immediately informs the stakeholders in accordance with Resolution of the RF Government from 24/03/1997 No.334 and the Statute adopted by Resolution of the RF Government from 14/02/2000 No. 128.

39. Information on the state of the environment received by subsoil user at his expense is the user's property. Meteorological, hydrological and oceanological data as well as the data on marine environment pollution received through engineering-environmental survey are submitted by the Customer to the Unified State Data Fund on the State of Environment and its Pollution (USDF) on the basis of the contract concluded with the organization-participant of activities on compiling, managing and storing of the USDF documents. This contract is to specify terms of data transfer, their further use and the cost and payment procedure for the services on expertise, acquisition, recording and storage of documents. The Executor has the right to use the information on the state of the environment received as a result of engineering-environmental survey for scientific purposes, unless otherwise provided by the contract.

40. To inform the population of environmental protection in the course of search, prospecting and development of mineral resources and the environmental situation in the operations area, the results of engineering-environmental survey contained in the reports on environmental impact and environmental consequences and in the overview of environmental consequences of emergency oil spills, must be displayed at the Customer's web-site as a popular science review. The generalized and illustrated survey materials are used by the Customer to prepare press-releases submitted to the mass media.

41. Subsoil resources user develops a programme of engineering-environmental survey (research and monitoring) for the whole period of license validity or for certain stages of activities on the search, prospecting and development of mineral resources in the Russian subsoil sector of the Caspian Sea. The

programme is to determine geographic coordinates of stations to implement regional environmental survey and organizational, technical and methodical requirements to the implementation of engineering-environmental survey taking into account specific natural conditions and anthropogenic load on the license area.

42. The programme of engineering-environmental survey (research and monitoring) and its annexes containing coordinates of stations of local environmental surveys must be endorsed with the federal executive agency implementing state environmental control in the Russian subsoil sector of the Caspian Sea as its territorial agency located in the Caspian littoral constituent entities of the federation, where the subsoil user is legally registered or (if it is registered outside Caspian littoral region) its branch or subsidiary is legally registered.

43. The programmes of industrial environmental monitoring containing coordinates of stations where observations are planned compose the project documentation (section "The list of activities on environment protection" or "Protection of subsoil and the environment") submitted for state environmental expertise. IEM programmes which are annexes to the programme of engineering-environmental survey (research and monitoring) are adopted by the Customer after a positive project resolution of the state environmental expertise.

In conclusion it should be noted that search, prospecting and development of mineral resources are carried out by Russian companies in the shelf of the Black, the Azov, the Baltic Seas, in the Far East and in the Arctic. In accordance with the established procedure they are accompanied by engineering-environmental survey and industrial environmental monitoring. The practice of such operations in the Caspian shelf described in the article can be used for existing and planned development programmes of marine oil and gas deposits.

Chapter 3. Integration of different types of marine water areas monitoring at regional level[24]

As it has been said earlier, the management of anthropogenic load on any area is focused at the level of the RF constituent entities. For this reason, the integration of different monitoring types (USSEM), generalization of observations data and all-round environmental assessment must be implemented at the same level. Our vast country requires a unified information system on the state of the environment hierarchically organized and having at least two levels of information generalization: 1) at the level of constituent entities; 2) at the federal level.

One might say that all the constituent entities of the Federation annually issue and prepare (by federal pattern) the reports on the state and protection of the environment. This is a positive, but insufficient practice. The scope of environmental monitoring data received by the constituent entities of the Federation must be enough both for the development of regional standards of environmental quality and for regulation of anthropogenic load on the area.

Annual reports are enough as long as the methods and mechanisms of regional standard-setting in the field of environmental protection are "in embryo", and environmental awareness of the community rests awhile. But when the community awakes and calls for ecologists to pass from words to deeds, the scope of monitoring data submitted to the constituent entities of the Federation must surely expand.

According to Article 63 of the Federal Law "On Environmental Protection" (edited on 21/11/2011), state environmental monitoring is implemented by the federal executive agencies and governmental agencies of the constituent entities of the Russian Federation within their competence established by the legislation of the Russian Federation.

The authorities of the federal executive agency in the field of environmental monitoring in accordance with Article 5 of this law include:

- establishment of the procedure of the state environmental monitoring, the procedure of organization and functioning of the unified system of the state environmental monitoring, compiling the state system of observations of the state of the environment and supporting of the functioning of this system;

- establishment of the procedure of creation and exploitation of the state fund of data of the state environmental monitoring (further referred to as state data fund), the list of information types to be included, the procedure and conditions of

[24] By regional level we mean each of the Russian seas (including the Caspian Sea) considered separately. The sea can be accessed by one or several constituent entities of the RF.

information submission and the procedure of this information exchange;

- creation and exploitation of the state data fund;
- establishment of the procedure of data preparation for the annual state report on the state of the environment and environmental protection.

In accordance with Article 6 of the Law, the authorities of the constituent entities of the Federation, in accordance with the established procedure, include the participation in the state environmental monitoring with the *right* to establish and support within the constituent entity of the Russian Federation the functioning of territorial observations systems of the state of the environment which are part of the unified system of the state environmental monitoring.

This "right" is too strong a word. Is there a Governor in Russia (except for Moscow) who would use this right to establish territorial observation networks? That is why when additional information is needed the problem is solved in another way - through "merging" the state environmental monitoring performed by federal executive agencies with industrial (local) environmental monitoring performed by resource users.

A typical system of this kind is the System of Territorial-Industrial Environmental Monitoring (STIEM) established in Astrakhan region in the 90s to observe the state of the environment (mainly the atmospheric air pollution) in the location area of Astrakhan Gas Processing Complex (AGPC), a hazardous industrial facility (the gas produced at Astrakhan gas condensate deposit is characterized by a high content of sulphur). STIEM includes both Roshydromet and AGPC posts. AGPC is responsible for funding, and observations data are submitted to Roshydromet, AGPC, regional and municipal authorities and the community.

Astrakhan region, alongside with the Republic of Dagestan and the Republic of Kalmykia, is located in the Caspian region and belongs to Caspian littoral constituent entities of the Federation. It is Astrakhan region which became a platform for the development of oil and gas deposits of the Caspian Sea in the water area adjacent to the RF coast (after the conclusion of agreements on sea bottom division between Russia, Kazakhstan and Azerbaijan this water area is referred to as the Russian subsoil sector of the Caspian).

Oil and gas companies operating in the Caspian have launched a system of industrial (local) environmental monitoring (each in its license area). This resulted in the initiative put forward by Astrakhan region on the establishment of a STIEM - similar system in the Russian subsoil sector of the water area to raise the awareness of authorities and the community of the Caspian littoral constituent entities of the

Federation on the state of the Caspian Sea. The demand for this information is growing as a result of the lack of unambiguous, reasonable and credible explanation of the reasons of fish stock decrease (fish and fish-related issues play a more significant role for the community than for the region's economy).

Our attitude to the creation of the marine STIEM in the Russian subsoil sector of the Caspian is unambiguous - we are ready to assist in the implementation of any initiative aimed at the integration of environmental monitoring types (subsystems) at the local, territorial and regional levels, as it increases its public significance (all the specialists employed in this field don't want their efforts to be wasted).

The prerequisites for the establishment of the marine STIEM are not restricted to the need for information and necessity to increase monitoring efficiency. These prerequisites should also include:

- high organizational level of industrial (local) environmental monitoring, which is superior to marine USSEM subsystems in parameters and scope of coverage;

- participation of Roshydromet and Rosrybolovstvo organizations implementing state monitoring of the state and pollution of the marine environment and monitoring of water biological resources of the Caspian Sea respectively in industrial environmental monitoring upon the order of oil and gas companies;

- the need to integrate all types of environmental monitoring implemented in the Russian subsoil sector of the Caspian Sea to implement the responsibilities of the Russian Federation on the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (see Chapter 4).

The drawback is that the initiative on the STIEM establishment is put forward by the Caspian littoral constituent entities of the Federation, while the authorities to solve all the relevant issues, be it the use of natural resources of marine water areas or marine environment protection, belong to federal authorities. The coastal constituent entities of the Federation have some authorities concerning the inland sea water and territorial sea, but this category can't be applied to the Caspian Sea as its legal status is not determined.

Despite this fact, we took part in the preparation of feasibility study to realize the initiative of Astrakhan region on STIEM establishment. The first variant (it will be described in section 3.1) offered the cooperation of different monitoring types at the level of observation networks, and the second one (described in 3.2) - cooperation at the level of information systems. It should be noted that draft documents, described below were prepared in 2008-2010, i.e. before the amendments to the Federal Law "On Environmental Protection" came into force (they were adopted in the first

reading in June 2011), but we have not changed our offers and present them to the reader in the original variant.

3.1. Cooperation of monitoring observation networks of marine water areas at regional level

As it has been already mentioned, three out of all the participants of marine monitoring have permanent and mobile observation points - observation networks in the marine water areas. These are Roshydromet, Rosrybolovstvo and organizations implementing search, prospecting and development of mineral resources (subsoil users).

Duplication of observations concerning the areas and dates of observations and controlled parameters facilitate cooperation of observation networks. The need to cooperate is conditioned by the non-compliance of data and controversies of assessments related to differences in measurement methods and tools. The factor which hampers cooperation is the different designation of different types of marine monitoring held by Roshydromet, Rosrybolovstvo and subsoil users.

For example, all types of monitoring provide for observation of marine environment pollution, and the data of own observations are used by Roshydromet to assess anthropogenic load, by Rosrybolovstvo to assess the habitat of water biological resources and by subsoil users to assess the impact of industrial activity on the environment.

Cooperation is also hampered by institutional factors - subsoil users belong to real economy sector, while Roshydromet and Rosrybolovstvo - to state agencies; Roshydromet belongs to the Ministry of Natural Resources and Environment, and Rosrybolovstvo -to the Ministry of Agriculture.

Economic factors facilitate cooperation, but this cooperation is regarded by the parties from different points. Subsoil users regard cooperation with Roshydromet and Rosrybolovstvo as a way to reduce costs for monitoring, and Roshydromet and Rosrybolovstvo -as a source of additional income, covering the deficit of budget assignations. For example, for the past 15 years Roshydromet organizations have been carrying out observations of marine environmental pollution in the Caspian Sea at the stations of state observations service alongside with the operations upon the order of subsoil users.

Occasionally research and planning and surveying organizations, not related to Roshydromet or Rosrybolovstvo, take part in the implementation of orders for local (industrial) monitoring. To strengthen its position on this service market

Rosrybolovstvo makes a wide use of administrative resources - issuing licenses for production of bioresources (required for carrying out ichthyological research in subsoil use areas) and endorsement of estimates of damages for the fish stock.

Until recently, Roshydromet issued licenses for the activities in the field of hydrometeorology and related fields. After Resolution of the RF Government No. 20 from 19 January 2006 was adopted, which referred local monitoring to engineering surveys, the right to implement this monitoring was given to organizations having a permit of a self-regulated organizations for the implementation of engineering-environmental survey (Roshydromet license is no longer required).

This is a brief overview of the situation concerning the cooperation of different monitoring types at the time when we were elaborating offers on the solution of the problem. One of the first offers was a draft Statute on the organization and implementation of complex environmental monitoring of the Caspian Sea within the Russian subsoil sector. This is our only offer which covers the issue of cooperation of observation networks; but it is not restricted to that, as monitoring participants are offered to cooperate in the preparation of information products. The draft is presented below with the original items numbering.

Statute on the organization and implementation of the complex environmental monitoring of the Caspian Sea within the Russian subsoil sector (draft)

GENERAL PROVISIONS

1.1. The state environmental monitoring of the Caspian Sea is based on the complex, inter-agency approach to its implementation. Complex environmental monitoring of the Caspian Sea (CEM) is performed to:

- observe physical, chemical, biological processes occurring in the sea and the state of water bioresources;
- determine the level of marine environmental pollution and its sources, including transboundary transfer of pollutants;
-specify the impact of search, prospecting and production of hydrocarbons on the state of the marine environment and water bioresources;
- assess the changes in the Caspian Sea state under the impact of other anthropogenic and other natural factors;
- inform federal authorities and the authorities of the Caspian littoral constituent entities of the Federation on the current and expected changes in the Caspian Sea state, their reasons and consequences;
- ensure the implementation of the Framework Convention for the Protection of

the Marine Environment of the Caspian Sea by the Russian Federation.

1.2. Complex approach to the Caspian Sea monitoring is achieved through:

- simultaneous measurement of abiotic and biotic parameters;
- holding observations in the sea areas with different anthropogenic load;
- perfect combination of contact and distance observation methods;
- coverage of different scales of environmental parameters variability.

1.3. A complex approach to the Caspian Sea monitoring is realized through coordinated functioning of different monitoring types, interaction between all the monitoring participants within the framework of CEM observation and information systems.

1.4. The fact which fosters the implementation of the complex approach to the Caspian Sea monitoring is its combination with complex research of the Caspian Sea ecosystem aimed at determination of response mechanisms to the impact of external natural and anthropogenic factors.

2. Organization and functioning of CEM observation system.

CEM observation system is a well-organized combination of mobile and permanent points of observation of processes and phenomena occurring on the coast, in the water area, water column, bottom and subsoil of the Caspian Sea (within the Russian subsoil sector) and estuary areas of inflowing rivers.

2.1. Participants of CEM observation system

Participants of CEM observation system are listed as follows:

- Federal Service for Oversight of Natural Resources (Rosprirodnadzor), carrying out observations of the state of marine environment in the sea areas with the special regime of use and/or protection[25];
- Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet), carrying out observations of physical and chemical processes and the pollution level of the Caspian Sea and the estuaries of inflowing rivers;
- Federal Agency for Fishery (Rosrybolovstvo), carrying out observations of distribution, number and reproduction of water biological resources of the Caspian Sea;
- subsoil using enterprises, ensuring observations of the state of the environment at license areas in accordance with programmes of industrial (local) environmental monitoring.

2.2. CEM areas and base stations

To implement CEM taking into account characteristics of natural conditions,

[25] In 2008 the authorities of Rosprirodnadzor included the monitoring of inner sea water and territorial sea;

economic use and legal regime, the Russian subsoil sector of the Caspian Sea is subdivided into 32 districts, which location scheme and coordinates are presented at fig. 3.1. Geometric centre of each district is the CEM base station, which number corresponds to the number of the district.

2.3. Procedure of observations implementation

To implement CEM:

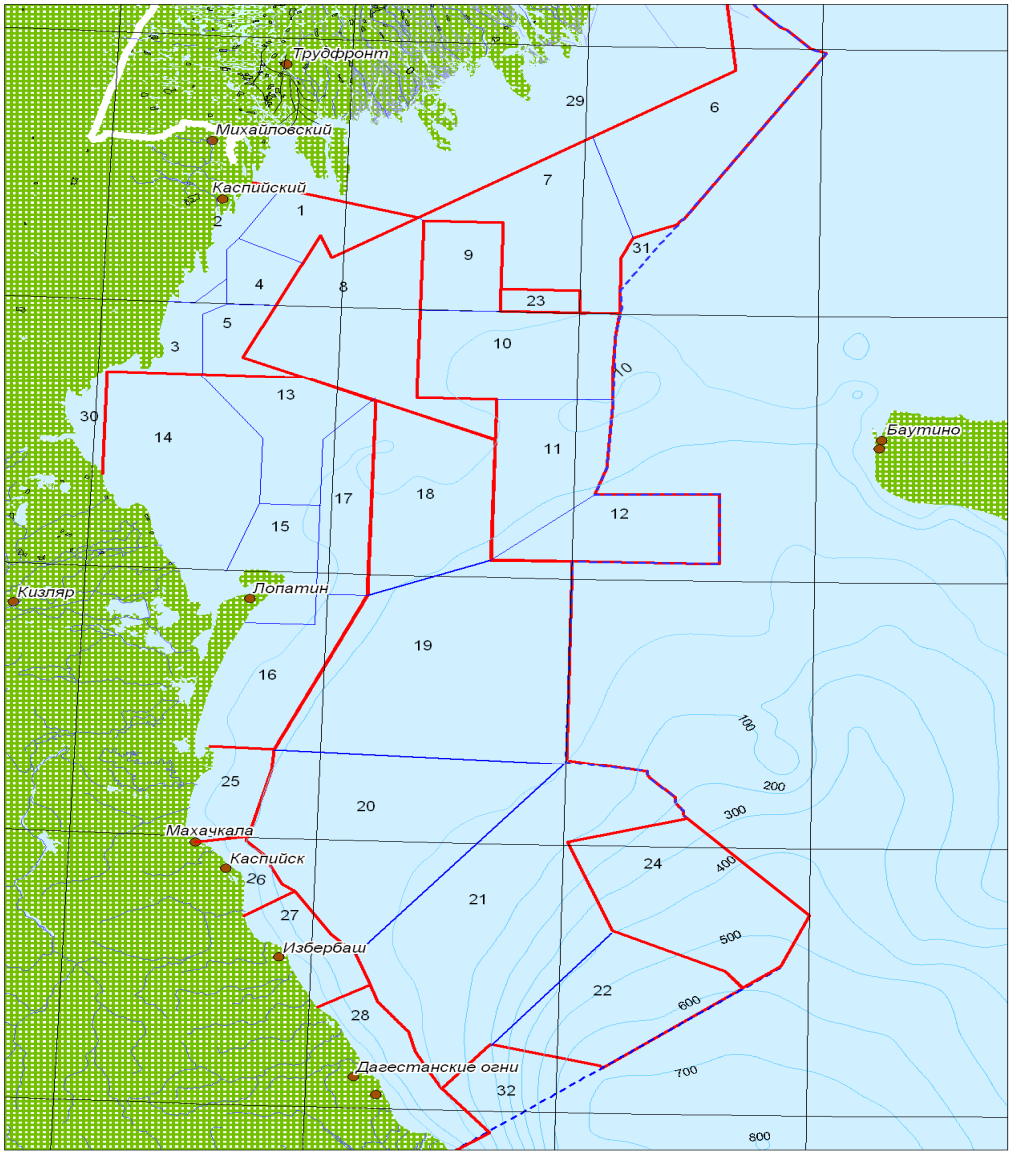
2.3.1. Performing the functions in the field of environmental monitoring, Rosprirodnadzor organizes and carries out observations of the state of marine environment and sea areas with the special regime of use and/or protection:

- the Volga delta wetlands;
- along the Volga-Caspian Canal;
- sector of the North Caspian adjacent to the Kazakh sector of subsoil use;
- sector of the Middle Caspian adjacent to the Kazakh and Azerbaijani subsoil sectors.

Observations are carried out at every station twice a year - in spring and in autumn- at 25-30 stations, evenly distributed in the water area.

The observation programme provides for determination of physical and chemical parameters of the state and pollution of the marine environment, which specified list is determined by Rosprirodnadzor in respect of every district depending on the regime of its use and/or protection.

2.3.2 Performing the functions in the field of environmental monitoring and ensuring its continuity, Roshydromet carries out observations of marine environmental pollution at the stations of categories I and II (in accordance with GOST 17.1.3.08-82), located in the Russian subsoil sector of the Caspian Sea.



Borders of licensed sites

Modified midline of the Caspian Sea bottom

Borders of sea areas

1 - Lagansky northern seaward site

2 - Lagansky northern coastal site

3 - Lagansky southern coastal site

4 - Lagansky central

15 - Tyuleny Tersky site

16 - Tyuleny Agrakhansky site

17 - Tuyleny sea site

18 - Central Caspian trapeziform site

19 - Central Caspian plain site

20 - Central Caspian triangle site

21 - Central Caspian sloping site

22 - Central Caspian

seaward site

5 - Lagansky southern seaward site

6 - Northern Caspian eastern site

7 - Northern Caspian central site

8 – Northern Caspian western site

9 - Northern Rakushechny site

10 - Northern latitudinal site

11 - Northern Sarmatian site

12 - Northern Khvalynsky site

13 - Tyuleny Volzhsky site

14 - Tyuleny Kizlyarsky site

rhombus-shaped site

23 - Eastern Rakushechny site

24 - Central site

25 - Sulaksky site

26 - Dimitrovsky site

27 - Izberbashsky site

28 - Derbentsky site

29 - Vodno-ugodny site

30 - Kumsky site

31 - Vostochny site

32 - Samursky site

Fig. 3.1. Zoning scheme of the Russian subsoil sector of the Caspian Sea for the purposes of complex environmental monitoring

In addition to the accomplished activities, Roshydromet organizes observations of marine environmental pollution at CEM base stations twice a year (spring and autumn), the content of observations being similar to that at stations of category III (in accordance with GOST 17.1.3.08-82).

Roshydromet observations at the base stations include measuring the concentration of pollutants (hydrocarbons and heavy metals) in samples of aerosol, surface film and bottom sediments.

2.3.3. Performing the functions in the field of environmental monitoring and ensuring its continuity, Rosrybolovstvo carries out observations of the state of water bioresources of the Caspian Sea in accordance with the agency-level programme.

In addition to the accomplished activities, Rosrybolovstvo organizes observations of the state of water bioresources at CEM base stations twice a year

(spring and autumn), the content of observations being similar to that of the agency-level programme.

Rosrybolovstvo observations at base stations include the determination of the state of neuston and biotesting of water and bottom sediments samples.

2.3.4. Subsoil using enterprises in accordance with the established requirements ensure the implementation of observations of the state of the environment at their license areas in accordance with the programmes of industrial (local) environmental monitoring agreed with Rosprirodnadzor, Roshydromet and Rosrybolovstvo.

2.3.4.1 Observations of the state of the environment are organized at all the stages of industrial activities at the polygons of the 3rd level, which borders coincide with the borders of the license area.

Each polygon of the 3rd level includes 25-30 stations evenly distributed in the water area. The observations there are held twice a year-in spring and in autumn. The number of stations at the polygon of the 3rd level includes CEM base station located within the polygon.

To ensure comparability of the data received from different sources:

observations of marine environmental pollution at the polygon of the 3rd level are held in accordance with the programme similar to extended Roshydromet programme for the stations of category III (see item 2.3.2);

observations of state of water biological resources at the polygon of the 3rd level are held in accordance with the programme similar to extended agency-level Roskomrybolovstvo programme (see item 2.3.3);

observations implemented at CEM base stations by subsoil using enterprises, Roshydromet and Rosrybolovstvo must be coordinated in time (the difference in observation terms should not exceed 10 days).

2.3.4.2 Throughout the period of prospect drilling observations of marine environmental pollution are organized at polygons of the 1st level. Each of the first level polygons includes 20-25 stations located at the distance of 100, 250, 500 and 1,000 m from the drilling platform, which is the polygon centre along the radiating axes, which direction is determined in accordance with the wind rose and the currents.

At the 1st level polygon observations consist of 3 stages: before the start, during and after the completion of drilling operations. At every stage all the stations hold single-time hydrometeorological and hydrochemical observations, determine physical and chemical properties of bottom sediments, measure concentration of pollutants (oil products, synthetic surfactants and heavy metals) in the samples of

marine water and bottom sediments, implement biotesting of these samples and hydrobiological observations including the determination of species composition, number and biomass of phyto-, zooplankto and zoobenthos.

2.3.4.3 During facility construction and exploitation of the deposit observations of marine environmental pollution and the state of water bioresources are organized at the polygons of the 2nd level.

Observations of marine environmental pollution at the polygons of the 2nd level are held 4 times a year (April, June, August, October) at 20-25 stations evenly distributed in the water area which area corresponds to that of the oilfield (oil and gas bearing block). Observations of marine environmental pollution are held in accordance with the programme similar to the programme of observations at the polygons of the 1st level.

Observations of the state of water biological resources at the polygons of the 2nd level are held 2 times a year (April, October) at 10-15 stations evenly distributed in the water area which area corresponds to that of the oilfield (oil and gas bearing block). Observations of the state of water biological resources are held in accordance with the programme similar to the agency-level programme of Rosrybolovstvo.

2.3.4.4 Subsoil using enterprises implement monitoring at the polygons of the 1st, 2nd and 3rd levels on their own or through employing organizations of any type of ownership and departmental subordination. The organizations carrying out observations of marine environmental pollution should be licensed for the activities in the field of hydrometeorology and related fields and dispose of analytical laboratories (centres) certified to carry out measurements in the field of monitoring of the state and pollution of the environment. Organizations carrying out observations of water biological resources must be licensed for extraction of these resources for research and control purposes.

2.3.4.5 Permanent oilfield facilities are equipped with automated meteorological stations and subsea platforms are equipped with automated sensors for measuring currents, waves, sea level, ice cover thickness, electric conductivity (salinity) and concentration of dissolved oxygen. In accordance with the established requirements permanent oilfield facilities must be equipped with automated tools for the detection of oil film and registration of its parameters. Automatic measurements of environmental parameters are held by subsoil using enterprises throughout the whole period of exploitation of permanent oilfield facilities with discreetness established by the programme of industrial (local) environmental monitoring.

2.3.4.6 Geodynamic monitoring which is an integral part of industrial (local) environmental monitoring is organized and held at all the stages of industrial

activities. Geodynamic monitoring includes continuous registration of seismic activity with help of bottom seismic stations installed at every license area, and periodic (twice a year - in spring and in autumn) measurements of physical, chemical and biological parameters of the surface layer of bottom sediments and the near-bottom water layer near the well-heads of abandoned wells and gas emissions from sea bottom identified by the data of geophysical and geochemical surveys.

Before the start of facility construction bottom seismic stations operate in automated mode, information retrieval and replacement of power batteries are held twice a year. After the construction of oilfield facilities bottom stations are installed near the platforms and connected to them by the cables aimed for power supply and data transmission. Registration of changes in the state of marine environment near the well-heads of abandoned wells and gas emissions from the sea bottom in the period between ship observations is implemented with help of bioindicator organisms.

To conduct geodynamic monitoring subsoil using enterprises employ organizations having experience of marine geodynamic research and observations of physical, chemical and biological processes in the marine water areas characterized by increased geodynamic activities.

2.3.4.6 Ornithological observations and observations of the state of animal species included in the Red book of the RF are carried out at all the stages of industrial activity at the license areas which border on wetlands and other protected areas and at the sites where protected objects are located. To conduct these observations which are part of industrial (local) environmental monitoring subsoil using enterprises employ organizations having experience in monitoring of fauna objects and long-term data necessary for comparative analysis..

2.4 Participants of the CEM observation system and the organizations involved to carry out observations irrespectively of their departmental subordination and legal organization immediately inform other participants of observation network and other organizations about extreme environmental pollution, **emergencies of anthropogenic origin, which have produced, are producing or can produce a negative impact on the environment in accordance with the procedure established by the RF Government**.

3. Organization and functioning of CEM information system

CEM information system is a well-organized combination of tools and technologies used for collection, processing, storage, transfer and distribution of information on the state of the environment of the Caspian Sea, the impact of external natural and anthropogenic factors and probable consequences of this impact.

3.1. Participants of CEM information system

Participants of CEM information system are the participants of CEM observation system (see item 2.1), organizations implementing geodynamic monitoring (in accordance with item 2.3.4.5 of this Statute) and monitoring of fauna objects (in accordance with item 2.3.4.6 of this Statute) and the organizations providing additional information resources (see item 3.2.2).

3.2 CEM information resources

CEM information resources are composed of the data of CEM observation system (main resources), the data on the state of the Caspian Sea received from other sources (additional resources), and the information-analytical materials on environmental situation in the Caspian Sea received through information analysis and processing (information products).

3.2.1 Main information resources are subdivided into distributed and shared resources. Shared resources include the data of observations of the state of marine environment and water bioresources at CEM base stations, which are submitted free of charge to other participants of CEM information system by the observer organization no later than 3 months after the observations are held. The distributed information resources include observations data owned by participants of CEM observation system.

3.2.2 CEM additional information resources include:

- separate (for every period) and composite (for several periods) maps of surface layer temperature (SLT), wind speed and direction, compiled by Roshydromet on the basis of satellite observations data;

- separate hydrometeorological maps (wind speed and direction, wave height and direction, current speed and direction, sea level), compiled by Roshydromet using the regional meteorological model and hydrodynamic model of the Caspian Sea;

- separate and composite maps of the Caspian Sea level, distribution of oil film (OF), and the distribution of chlorophyll and suspended matter (C&S), compiled by research institutions of the Russian Academy of Science on the basis of satellite observations data.

3.2.3 The creation of additional information resources is ensured by subsoil using enterprises using these resources for solving the tasks of industrial (local) environmental monitoring jointly with institutions of Roshydromet and the Russian Academy of Sciences (RAS), having relevant experience and technologies.

3.2.4 Additional information resources are also subdivided into distributed and shared resources. The distributed resources include all the maps listed in 3.2.2 submitted to nature management enterprises by the responsible organizations

immediately after preparation of materials; these resources are shared. Shared resources include composite (for 10 day periods and months) maps of SLT, OF and C&S and separate hydrometeorological maps describing hydrometeorological conditions within the reviewed periods concerning every natural synoptic period. Roshydromet and RAS organizations preparing these resources submit them free of charge to other participants of CEM information system once a quarter no later that 15 days after the completion of the previous quarter.

3.2 CEM information products

3.2.1 CEM information products include overviews of the state and pollution of the marine environment within the Russian subsoil sector of the Caspian Sea for the first/second six months period, and annual overviews of environmental situation in the Russian subsoil sector of the Caspian Sea.

3.2.2 To prepare information products participants of CEM information system establish an editorial committee. Committee Chairman and Secretary are elected by the majority of voices at the first meeting.

3.2.3 The content of the overview of the state and pollution of the marine environment within the Russian subsoil sector of the Caspian Sea for the first/second six months period is presented as follows:

Introduction

1. Hydrometeorological conditions

1.1 Meteorological conditions

1.2 Hydrological conditions

2. Oceanographic conditions

2.1 Hydrochemical conditions

2.2 Hydrobiological conditions

3. Marine environmental pollution

3.1 Frontier areas, wetlands and the Volga-Caspian canal

3.2 License areas

3.3 Coastal area and the open sea

Conclusion

3.2.4. Overviews of the state and pollution of the marine environment within the Russian subsoil sector of the Caspian Sea for the first/second six months period are prepared by Roshydromet (part 1, sections 2.1 and 3.3), Rosprirodnadzor (section 3.1), Rosrybolovstvo (section 2.2) and subsoil using enterprises (section 3.2, for

every license area separately). Each section must be preceded by a description of data, main, additional and private information resources used for its preparation. The introduction and the conclusion are made by Secretary of the editorial committee. Committee Chairman provides a scientific revision of the overview taking into account offers and remarks made by members of the Committee. The overview for the first half-year period must be prepared by August 25, for the second half-year period - by February 25 of the following year.

3.2.5 The content of the annual overview of environmental situation within the Russian subsoil sector of the Caspian Sea is presented as follows:

Introduction

1. *Hydrometeorological conditions*
   - 1.1 *Synoptic processes and meteorological conditions*
   - 1.2 *Hydrological conditions Water circulation*
   - 1.3 *Hydrometeorological hazards*
2. *Hydrochemical conditions*
   - 2.1 *Dissolved salts and gases*
   - 2.2 *Biogenic elements*
3. *Geodynamic processes*
   - 3.1 *Seismic activity*
   - 3.2 *Subsoil impact on the marine environment*
4. *Marine environmental pollution*
   - 4.1 *Frontier areas, wetlands and the Volga-Caspian canal*
   - 4.2 *License areas*
   - 4.3 *Coastal area and the open sea*
   - 4.4 *Pollutants inflow from on-land sources*
     - 4.4.1 *Surface runoff*
     - 4.4.2 *Sewage discharge*
5. *Biological productivity and state of water bioresources*
   - 5.1 *Volga-Caspian Canal*
   - 5.2 *North-Western area*
   - 5.3 *North-Caspian area*
   - 5.4 *Terek-Caspian area*
6. *The state of fauna objects and protected areas*
7. *Impact assessment of natural factors on environmental conditions of the Russian subsoil sector of the Caspian Sea*
8. *Impact assessment of anthropogenic factors on*

environmental conditions of the Russian subsoil sector of the Caspian Sea

Conclusion

3.2.6. Annual overview of environmental situation within the Russian subsoil sector of the Caspian Sea is implemented by Roshydromet (Part 1, 2; Sections 4.3, 4.4.1, 4.5, 4.7), Rosprirodnadzor (Sections 41 and 4.4.2 - based on the data by Rosvodresursy and Rostekhnadzor, and Parts 6 and 8), Rosrybolovstvo (Part 5) and subsoil using enterprises (Section 4.2, each for the relevant license area). Each section must be preceded by a description of data, main, additional and private information resources used for its preparation. The introduction and the conclusion are made by Secretary of the editorial committee. Committee Chairman provides a scientific revision of the overview taking into account offers and remarks made by members of the Committee. The annual overview is to be prepared by April 30 of the following year.

3.2.7. CEM information products are forwarded to governmental agencies of the Russian Federation, authorities of the Caspian littoral constituent entity of the Russian Federation and used for the preparation of the annual state report on the state of the environment.

4. Final provisions

To implement CEM:

4.1. Federal executive agencies participating in CEM:

- determine the list of subordinate institutions included in CEM observation and information systems;

- ensure funding of the operations through assignations on provision of functions in the field of environmental monitoring and implementation of research in the field.

4.2 Subsoil using enterprises in accordance with this Statute introduce changes into the programmes of industrial (local) environmental monitoring, provide its sustainable functioning through the funds assigned for environmental protection.

4.3. Rosprirodnadzor annually organizes and holds the meeting of CEM participants, ensures copying and distribution of CEM information products and ,jointly with RAS, coordinates CEM with complex research of the Caspian Sea.

We considered this statute, or its original draft to be more precise, as a subject of a certain agreement which monitoring participants are to conclude between each other. As monitoring participants are federal executive agencies on the one part and

private economy sector on the other, this agreement could be considered as an example of state-private partnership. Unfortunately, the dream failed to come true. But our attempts to develop an acceptable variant of cooperation of different monitoring types in the Russian subsoil sector of the Caspian Sea are not restricted to this only project.

3.2. Cooperation of information systems of marine water areas monitoring at regional level

Cooperation of information systems pursues two goals: 1) combination of these systems into a single information system; 2) creation of new information products through generalizing observations data (held by different participants of marine monitoring), elimination of inconsistencies and raising validity of information by means of all-round (complex) assessment of the state of marine environment. Both information consumers and participants of marine monitoring are interested in achieving these goals.

Cooperation of information systems requires additional efforts for the development of the unified information system and elaboration of new information products. That is why cooperation is possible only when one of monitoring participants takes the trouble to implement this work and the funds to pay for this work are found (which is not always possible). Extra obstacles for cooperation of information systems are departmental barriers, commercialization of information and the fear that the information can be used to harm its creator.

There are two ways to create a unified information system: 1) on the basis of the unified database; 2) on the basis of distributed databases. There are also two ways for the all-round assessment of the state of marine environment: 1) unified assessment based on the analysis and generalization of primary data; 2) consolidated assessment ("assessment of assessment") based on generalization of basic assessments held by every monitoring participant.

The cooperation of information systems of environmental monitoring in Russia took the path of distributed databases (example - the Unified System of Information of the Situation in the World Ocean) and consolidated assessments (example - state reports on the state and protection of the environment). However the creation of the state data fund of the state environmental monitoring (SDFEM) in accordance with the new edition of the federal law "On Environmental Protection" means that it's early to put an end to the first path.

We have spoken of the need to create regional ESIMO modules (including the Caspian - see section 1.5) and to establish SDFEM branches in the constituent entities of the Federation (see section 1.4), but such decisions can be taken only at federal level. What can constituent entities of the Federation do for the cooperation of information systems of marine monitoring at the regional level? What can serve as a legal background for the initiatives in this field? In our opinion, the legal background can be constituted by the right for favourable environment and valid information about its state determined by the RF Constitution and the right of the coastal constituent entities of the Federation to participate in monitoring of inland water, territorial sea and the adjacent area stipulated in the relevant federal law.

To exercise these rights concerning generalized information on the state of the Caspian Sea at the regional level we have prepared a draft Resolution of the Governor of Astrakhan Region "On preparation of annual report "On the state of the environment of the western part of the North Caspian" presented below.

Resolution of the Governor of Astrakhan Region "On preparation of annual report "On the state of the environment of the western part of the North Caspian" (draft)

To exercise the right of citizens for favourable environment and valid information on its state, to ensure the participation of Astrakhan region in environmental monitoring of the Caspian Sea in accordance with the legislation of the Russian Federation, to regulate the load of marine economy of Astrakhan Region on the environment, to ensure its environmental security and upon the agreement with the Ministry of Natural Resources and Environment of the Russian Federation and Federal Agency for Fishery, the Governor of Astrakhan Region passes a resolution to:

1. To adopt the preparation procedure of the annual report "On the state of the environment in the western part of the North Caspian";

2. To appoint the Service for Nature Management and Environment Protection of Astrakhan Region the executor of the annual report "On the state of the environment in the western part of the North Caspian";

3. Agency for Press and Mass Communications of Astrakhan Region to publish this Resolution in the mass media.

4. The Resolution comes into force on the date of its official publication.

The preparation procedure of the annual report "On the state of the

environment in the western part of the North Caspian"

1. The annual report "On the state of the environment in the western part of the North Caspian" includes:

Introduction, determining the designation of the report, describing its content, listing executors and the materials submitted by them.

Chapter 1. "Hydrometeorological conditions", describing synoptic processes in the atmosphere above the Caspian Sea and changes of hydrometeorological parameters for months (including average, minimum and maximum temperature of air and the marine water, average and maximum wind speed and direction; maximum and minimum sea level and ice conditions in the water area) according to the observations data at Roshydromet stations and posts located on the coast and islands of the North Caspian and to satellite data within the reviewed year in comparison to the previous year and long-term data.

Chapter 2. "Surface runoff", describing monthly changes of average, maximum and minimum temperature of the river water, the volume of water and solid discharge and chemical discharge at the top of the Volga delta (chemical discharge includes ionic discharge, the discharge of biogenic salts and pollutants) within the reviewed year in comparison to the previous year and long-term data.

Chapter 3 "Coastal and marine ecosystems", describing the state of flora and fauna of protected areas (Astrakhan State Biosphere Reserve, Delta Volga wetlands, natural landmark of federal importance "Maly Zhemchuzhny Island", plankton and benthic biological communities in the Volga-Caspian, North-Caspian and North-Western fishery districts of the Volga-Kama Fishery basin within the reviewed year in comparison to the previous year and long-term data.

Chapter 4 "Environmental situation in navigation and dredging areas" describing the intensity of navigation in the Volga-Caspian Canal, the scope of accomplished dredging operations in its marine part and in fish pass canals, the pollution of marine environment of dredging operations and subwater dumps of extracted soil according to the data of industrial environmental monitoring within the reviewed year in comparison to the previous year and long-term data.

Chapter 5. "Environmental situation in the areas of search, prospecting and development of hydrocarbon deposits", describing the scope of geology prospecting operations, the number of drilled wells, the volume of oil and gas production, the volume of emissions, discharge and waste, the pollution of the marine environment at license areas as a whole and in the areas of operations, the results of pollution diagnosis and complex assessment of marine environment quality according to the

data of engineering-environmental survey and industrial environmental monitoring within the reviewed year in comparison to the previous year and long-term data. The data of engineering-environmental survey and industrial environmental monitoring are to be compared with the data of state monitoring of marine environment pollution carried out by Roshydromet.

Chapter 6. "Water bioresources", describing the state of stock and catches of commercial fish species in the southern fishery district of the Volga-Caspian fishery basin, the level of its artificial and natural reproduction, toxicosis sickness rate among fish within the reviewed year in comparison to the previous year and long-term data.

Chapter 7. "Assessment of the state of the environment", containing assessment of the environment of the western part of the North Caspian according to composite and integral parameters, the assessment of permissible anthropogenic load on the marine water area, the recommendations on regulation of the load of the marine economy of Astrakhan Region on the environment and ensuring its environmental security.

The Conclusion containing the assessment of trends in changes of the state of the environment of the western part of the North Caspian and recommendations to the federal executive agencies on environment protection and efficient use of natural resources of the Caspian Sea.

2. The executors of the annual report "On the state of the environment in the western part of the North Caspian" are listed as follows:

Service for nature management and environment protection of Astrakhan region (Chief Executor, Introduction, Conclusion, report distribution);

Directorate of Fishery of Astrakhan region (Chapters 4 and 6);

FSBI "Caspian marine scientific research centre" (Editor-in-chief, Chapters 1,2 and 7)

SI "Astrakhan Centre for hydrometeorology and environmental monitoring" (Chapters 1 and 2);

FSBI "Astrakhan state nature biosphere reserve" (Chapter 3);

FSUE "Caspian Research Institute for Fishery" (Chapters 3 and 6);

FSBI "North Caspian Directorate for Provision at Sea / Technical Ensurance" (Chapter 4);

FSBI "North Caspian basin authority on conservation and reproduction of fish resources" (Chapter 6);

"LUKOIL-Nizhnevolzhskneft" Ltd. (Chapter 5, section "Environmental situation at the area "Severny");

"Caspian Oil Company" Ltd. (Chapter 5, section "Environmental situation at the area "North-Caspian area");

"Petro-Resurs" Ltd. (Chapter 5, section "Environmental situation at the area "Lagansky");

"Caspian oil and gas company" Ltd. (Chapter 5, section "Environmental situation at the area "Khvalynskoye");

Astrakhan branch of FSUE "Rosmorport" (Chapter 4).

3. The executors of the annual report "On the state of the environment of the western part of the Caspian Sea" annually before March 1 of the following year submit to the editor-in-chief the information-analytical materials in accordance with item 2 to be included in the annual report.

The editor-in-chief revises the report before April 1 and submits the revised report to the executor-in-charge. Drafting amendments (with the exception of those of technical nature) must be agreed with the executors. The editor-in-chief sets unified requirements to the execution of the information-analytical materials submitted by executors.

The executor-in-chief publishes the annual report "On the state of the environment of the western part of the Caspian Sea" at its website and replicates the report by April 30. The hard copies of the annual report are submitted to Governor of Astrakhan Region, organizations-members of the Marine Council by Governor of Astrakhan Region, Plenipotentiary of the RF President in the Southern Federal District, federal executive agencies belonging to nature management complex, Astrakhan Regional Scientific Library named after N.K. Krupskaya, the libraries of nAstrakhan State University and Astrakhan State Technical University.

The presented above Draft Resolution of the Governor of Astrakhan Region has not been realized. Our unsuccessful attempts show that in spite of the public demand and actual preconditions, the integration of different types of marine water monitoring at the regional level has not yet got off the ground. The underlying reason is the absence of the regional mechanism linking environmental monitoring and environmental regulation. In contrast to the existing Unified system of environmental monitoring based mainly at federal level, the future Unified system of environmental standard-setting, assessment and monitoring, which is sure to emerge, will be based at regional level.

The integration of different monitoring types will hardly have to do with observation networks. It will obviously be restricted to the cooperation of information systems and integration of information resources. In the nearest future this

cooperation will be implemented in the top-down manner. As far as the monitoring of the Russian subsoil sector of the Caspian Sea is concerned, in our opinion it would be best to create Caspian module of the Unified System of Information on the Situation in the World Ocean. To achieve this ESIMO should be completed with the block of marine environment protection. Environmental protection should always precede environmental monitoring. Otherwise, environmental monitoring will make no headway. Improvement of environmental protection will lead to the improvement of environmental monitoring.

Chapter 4. International experience in environmental monitoring of water bodies

4.1. General principles of environmental monitoring

Economic and environmental negative consequences of the utilization of freshwater and marine resources in industrialized countries in the first three quarters of the last century have brought many of the countries on the edge of the environmental and water crisis. Realizing these threats has resulted in paradigm shift in the field of water and environmental resource management in the industrialized world. The new paradigm has focused on the preservation, restoration and protection of the water and marine ecosystems and their services as the fundamental precondition of the existence of the humanity and the critical source of the societal development. The process of incorporating environmental concerns in to decision making, sectoral policies and budgeting process is guided by five main principles that include:

- Polluter pays principle (PPP)
- User pays principle (UPP) (or resource pricing principle).
- Precautionary principle (PP).
- Subsidiary principle (SP)
- Intergenerational equity principle (IEP)

The Polluter Pays Principle was first widely discussed in the United Nations Conference on Environment and Development held in Rio de Janeiro of Brazil in June 1992. The PPP required that the polluter has to bear the cost of complying with environmental standards, which are predetermined by public authorities. If the polluters have to pay for the cost of any pollution they cause, market forces will then encourage them to change their activities either by introducing new pollution control technologies or by switching to more efficient production process.

The User Pays Principle states that the beneficiaries should pay for the full cost of using the resources and its related service; the full cost included the cost of losses for future generations. Both PPP and UPP principle considered as equitable and both offer the prospect of achieving efficiency.

The Precautionary Principle was adopted by the UN Conference on Environment and Development (the Earth Summit) in 1992. According to Rio Declaration on Environment and Development Precautionary Principle means that where there are threats of serious or irreversible damage to environment, lack of

scientific certainty should not be used as an excuse for postponing cost effective measures to prevent environmental degradation. This principle is seeking present and eases environmental stress before conclusive evidence of damage exists and adopts policy when raw evidence is available.

The Subsidiary Principle states that political decisions should be taken at lowest possible level of public authority securing an effective action. So that setting standards and interpreting risk are a politically involved process. The SP recommends that these decisions are made by the authorities that are closed to the population concerned. SP provides useful guidance when applying the PPP and UPP and the PP.

The Intergenerational Equity Principle is the central principle in the definition of sustainable development. According to the Brundtland Report sustainability is the 'meeting the needs of present generations without compromising the needs of future generations'. Generally this principle is considered with the trilogy of economic, environmental and social objectives underlying sustainable development. This principle is the basis of the environmental accounting measures of sustainable income.

Integrated management

The concept of "Integrated Water Resources Management" (IWRM) was introduced in its modern interpretation at the United Nations Conference on Environment and Development in Rio in 1992 (Chapter 18 of Agenda 21), and it has since that time evolved, somewhat differently in different countries, depending on their, geography, culture and stage of development.

A properly functioning environmental (water, marine) monitoring programme producing robust and reliable data is a prerequisite for an effective management system. Whether or not the environment quality meets the established targets and standards can only be determined by routinely measuring it. The monitoring data are also a major input into the next cycle of the planning and management. It is always done for purpose and closely linked to resource management; actually it is a part of the management aimed to track the progress towards stated management goals.

Monitoring as defined by the International Organization for Standardization (ISO) is "the programmed process of sampling, measurement and subsequent recording or signaling, or both, of various water characteristics, often with the aim of addressing conformity to specific objectives" (quoted from Chapman (1996)). Monitoring per se is concerned with the procedures and activities for collecting data and information in the formulation and implementation stages of an action or a series of initiatives. It is particularly aimed at providing regular feedback to guarantee

coherence, efficiency and effectiveness against the underlying objectives set at the national and international levels.

Before 1990th regulatory and legal liability issues in marine environmental monitoring prevailed that have led to programs based on reductionist models that used non-biological parameters which are indirect measures of biotic condition. This lessened the effectiveness of monitoring programs as they rarely served the function for which they were intended: an accurate and sensitive source of information from which conditions and trends could be defined and recognized, and management decisions made. In addition, the natural variability of systems was problematic to reveal in order to distinguish natural from anthropogenic changes in environmental conditions (Thomas 1993). This has driven the monitoring to evolve into a set of assessment activities that include the use of water chemistry, analysis of particulate materials (suspended solids and sediments) and aquatic biota.

The overall goal of all types of monitoring programs is the protection of the environment and its resources. Data collected from monitoring programs document existing conditions, and help document changes in these conditions over time. Lacking prior knowledge of environmental conditions, monitoring establishes a baseline for future comparisons. One can distinguish between three types of monitoring activities - long-term, short-term and continuous monitoring programs, which can be defined as follows:

- Monitoring is a long-term, standardized measurement and observation of the aquatic environment to define status and trends;
- Surveys are finite duration, intensive programs to measure and observe the quality of the aquatic environment for a specific purpose;
- Surveillance is continuous, specific measurement and observation for the purpose of water quality management and operational activities.

The monitoring may consider only one type of water (e.g., lakes, estuaries, seas etc.) or only one approach of monitoring (e.g., physiochemical or biological methods). A combined use of water, particulate matter and biological monitoring produces comprehensive water quality assessments for most types of water bodies. Two types of monitoring of water bodies (both freshwater and marine) can also be distinguished by the purpose of the monitoring:

1) monitoring compliance with the relevant laws and regulations;

2) monitoring of exploited (receiving) water body.

Marine monitoring programs are usually long-term, data intensive programs that establish points of reference for environmental conditions and then attempt to document and identify change in these conditions over time. Programs using

macrobenthos and water quality measures are widely used in marine and estuarine settings. Assessment programs, smaller in scope and application, are generally more short-term and data-specific than typical monitoring programs. They are intended to measure specific parameters or conditions. Bioassay is a type of assessment program that uses live organisms to measure a variety of conditions or specific impacts (Thomas 1993).

Principal elements of a monitoring program usually include:

- A clear statement of aims and objectives
- Information expectations and intended uses
- A description of the study areas concerned
- A description of the sampling sites
- A listing of the water quality variables that will be measured
- Proposed frequency and timing of sampling
- An estimate of the resources required to implement the design
- A plan for quality control and quality assurance.

Compliance Monitoring (Principles, 2009)

Compliance monitoring is one of the key components government agencies and others use to ensure that the regulated community obeys environmental laws and regulations through on-site visits by qualified inspectors, public reporting of violations, and by reviewing information submitted to it by the regulated industry as part of self-monitoring and reporting programs. Compliance monitoring is generally considered to include both self-monitoring by the regulated entity, and governmental inspections and investigations (Principles, 2009).

There are four primary sources of compliance information discussed in this chapter:

- Inspections.
- Monitoring environmental conditions near a facility.
- Self-monitoring, recordkeeping, and self-reporting by the regulated community.
- Citizen monitoring.

Table 1 summarizes the advantages and disadvantages of these four information sources. Additional information may come from reports of other national, regional, provincial, or local agencies that have related jurisdiction over the facility; requests for modifications to permits or licenses; and environmental audit reports provided by the facility. However, as information on compliance status is

gathered, an enforcement program needs a system (computerized if possible) to store, access, and analyze the information as needed.

Table 4.1
Strengths and weaknesses of primary sources of compliance information (adapted from: INECE, 2009)

Information source	Strengths	Weaknesses
Inspections	Provide the most relevant and reliable information.	Can be very resource-intensive. Must be carefully targeted and planned.
Self-Monitoring, Self-Recordkeeping, Self-Reporting	Provide much more extensive and information on compliance. Shift economic burden of monitoring to the regulated community. May increase level of management attention to compliance within a facility.	Rely on integrity and capability of source to provide accurate data. Place a burden on the regulated community and increase the paperwork for the devoted compliance program.
Citizens	Can detect violations that are not detected by inspections or industry self-monitoring, -reporting, and -record- keeping.	Sporadic. Cannot control the amount, frequency, or quality of information received. Only a few violations are noticed by citizens.
Area Monitoring	Useful for detecting possible violations without entering the facility. Also useful for determining whether permit or license requirements are providing adequate environmental protection.	Can be difficult to demonstrate a connection between the pollution detected and a specific source. Difficult or impossible to obtain precise information. Resource-intensive in areas of multiple sources.

4.2. Environmental monitoring in the European Union

Water protection is one of the priorities of the EU. European water-related environmental policy started its active formation in mid- 1970s with standards for surface water supply sources. In 1980 the targets for drinking water, fish waters, bathing waters and ground waters were set. For many years European water quality monitoring practice has been subdivided by two approaches:

- control of the sources of pollution through the application of available technologies;
- focusing on the quality status of the receiving environment.

There are potential shortcomings when only one of these approaches is applied. Source controls do not take into account the cumulative toxic effects of contaminants from a number of different sources of pollution. The diffuse impacts cannot be estimated. Quality standards applied to water bodies can underestimate the effects of particular substances on the ecosystem, due to lack of scientific knowledge regarding the final outcome of substances in the environment. This approach may also lead to gradual degradation of a water body, if its initial state was better than standard.

Measuring the performance and impact of complex water-related programs or initiatives is an essential task. In this way, it would be possible to track the actual implementation of all initiatives and promote the integration of various activities into the overall development frameworks.

Marine Directive (2008)

The Marine Directive provides the legal impetus for the EU to protect and clean up its seas and oceans as part of an integrated strategy in order to use them sustainably. The Marine Directive was adopted on 17 June 2008 and was due to be transposed into national legislation by 15 July 2010. It establishes an integrated approach to maritime activities and provides a long-term policy vision for Europe's marine environment.

The overall objective is to achieve or maintain Good Environmental Status (GES) of the EU's marine waters by 2020, thus protecting the resources on which marine-related economic and social activities depend. The Directive envisages an ecosystem-based approach to the management of all human activities that have an impact on the marine environment. The Directive foresees a regional approach to implementation, and establishes European Marine Regions on the basis of geographical and environmental criteria. However, Member States must adopt common approaches by:

- working to a common and ambitious timeline to meet GES by 2020 - developing Marine Strategies in cooperation with neighboring countries and, where practical and appropriate, using existing regional cooperation structures, including under regional sea conventions
- adopting an adaptive management approach so that strategies are kept up-to-date and reviewed every six years.

The Marine Directive builds on existing EU legislation and covers specific elements of the marine environment not addressed in other policies. Some of the key legislation and policies directly relevant to the Directive are described below.

Water Framework Directive (2000) is closely linked to the Marine Directive. It sets a goal of achieving Good Status for all EU surface and groundwaters by 2015, tying in with the goal of Good Environmental Status under the Marine Directive. Following an adaptive management approach, it establishes a six-year planning cycle, during which Member States prepare River Basin Management Plans and develop actions and measures to achieve Good Status by 2015. Initial plans were published in 2009 and will be reviewed in 2015. Actions taken will reduce marine pollution from land-based sources and will protect ecosystems in coastal and transitional waters, which are vital spawning grounds for many marine fish species.

The Habitats and Birds Directives (1992 and 1979, codified 2009) are Europe's central laws on nature conservation, providing special protection for key sites (the Natura 2000 network), animal species, plant species and habitat types of European importance. This protection will be reinforced with the Marine Directive's Marine Protected Areas.

Common Fisheries Policy (2002) sets out a collaborative approach to managing the EU's shared seas and fisheries. Among other things, it lays down rules to ensure Europe's fisheries are sustainable and do not damage the marine environment. The planned reform in 2011 should take into account the environmental impacts of fishing and the objectives of the Marine Directive to help ensure they are met.

Recommendation on Integrated Coastal Zone Management *(*2002, to be reviewed in 2011) and the Roadmap on Maritime Spatial Planning (2008) define the principles of sound coastal and maritime planning and management. The aim is to promote rational and sustainable use of the sea, balance the socio-economic and environmental interests and improve the quality of decisions.

The prime objective of an ***Integrated maritime policy for the EU*** (2008) is to maximize sustainable use of the oceans and seas while enabling growth of the

maritime economy and coastal regions. A second key objective is building a knowledge and innovation base for the maritime policy. Marine science, technology and research enable analysis of the effects of human activity on marine systems and put forward solutions to alleviate environmental degradation and the effects of climate change. An integrated policy also has the objective of delivering a higher quality of life in coastal and outermost regions, reconciled with economic development and environmental sustainability. The EU intends, moreover, to promote its leading position in international maritime affairs. An integrated policy enables improved management of maritime affairs and the creation of EU priorities in this field. The final objective of this integrated policy is raising the visibility of Maritime Europe and improving the image of this sector's activities and professions.

On an international level, the Marine Directive responds to the EU's international obligations as set out in the Convention on Biological Diversity (CBD) and the United Nations Convention on the Law of the Sea (UNCLOS). These Conventions require the signatories to integrate the study, the protection and the preservation of their marine resources and biodiversity into the development and management of the policies that affect their marine environment.

4.3. The environmental monitoring program for seas and coastal areas in Sweden

The environmental monitoring program for seas and coastal areas provides input for the description of large-scale human impacts on the marine environment. Data generated within the program are used for international reporting and for tracking progress towards the national environmental quality objectives, etc. Since 1 July 2011, the responsibility for this monitoring program is shared by the Swedish Environmental Protection Agency (SEPA) and the Swedish Agency for Marine and Water Management.

The Swedish Agency for Marine and Water Management holds six sub-programs that monitor changes in the marine environment, and the Swedish EPA is responsible for sub-programs or parts of sub-programs that are related to environmental pollutants, coastal fish populations and fish health, top predators (seals and white-tailed sea eagle) and hazardous substances in marine biota.

Transboundary issues

Most threats to the marine environment are transboundary in nature. Sweden's waters are affected by a catchment area that is inhabited by approximately 80 million

people and affected by human activities in Central Europe. Marine environmental monitoring is therefore strongly international in character, and many of its activities are governed by marine conventions and bilateral agreements. Increasingly environmental issues are regulated through the EU at a supranational level, and the trend is for monitoring to be more directive-driven.

International cooperation

Long time-series data of high quality are a cornerstone of environmental monitoring. Designed to provide information on the coastal and marine environment to meet Swedish and certain international needs, much of Swedish marine monitoring program is coordinated with programs run by other countries. Common open-sea observation sites are visited by research vessels from several countries, and similar observation programs are conducted in the coastal regions of neighboring countries. A large-scale picture of the status and chronological development of the marine neighborhood – the Baltic Sea and the Skagerrak–Kattegat – emerges from the regular joint evaluation of environmental data.

4.4. Environmental monitoring in USA

The major federal law governing water is the Clean Water Act (CWA) that establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977.

US Environmental Protection Agency (USEPA) works with its federal, state and tribal regulatory partners to assure compliance with clean water laws and regulations in order to protect human health and the environment. Under the CWA, USEPA has implemented pollution control programs such as setting wastewater standards for industry and water quality standards for all contaminants in surface waters.

The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. USEPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a

surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

Clean Water Act Compliance Monitoring

Compliance monitoring in the National Pollutant Discharge Elimination System (NPDES) program encompasses analyses of Discharge Monitoring Reports (DMRs) which provide continuous monitoring information from permitted facilities on the characteristics of their effluent discharges, guidance to state and EPA regional inspectors on how and when to conduct inspections, and inspector training.

USEPA and states conduct periodic inspections and audits of the Publicly Owned Treatment Works (POTW) pretreatment implementation programs to ensure that the programs are being properly implemented. USEPA conducts inspections of facilities that storage oil to insure that the facility satisfies requirements designed to prevent oil spills. USEPA conducts inspections of three types of facility operations subject to the storm water regulations: construction sites, industrial sites, and municipal separate storm sewer systems (MS4). For MS4 operations, USEPA also conducts audits designed as a comprehensive review of all facets of the Control Authority's storm water program. USEPA conducts inspections of sites to determine whether dredged or fill material is being illegally dumped into wetlands in violation of the regulations and statute; to verify whether and if facilities/sites have a wetlands permit and are complying with it; and whether steps are being taken to minimize or avoid wetland impacts where practicable. An annual quality assurance (QA) study conducted to evaluate the analytical and reporting ability of permittees and laboratories routinely performing inorganic chemistry and whole-effluent toxicity self-monitoring analyses required in NPDES permits.

Aquatic Resource Monitoring Programs

Many Federal and State agencies, including Tribal Governments, conduct aquatic resource survey and monitoring programs. Some of these programs have adopted, are evaluating or considering the use of probability designs and linkages to the approaches developed by ORD's EMAP. The Aquatic Monitoring Design & Analysis Team is contributing to and collaborating with many of the following programs:

- National Water Quality Monitoring Council (NWQMC)
- Intergovernmental Task Force on Monitoring Water Quality (ITFM), 1992-1996
- EPA Office of Water (OWOW)

- National Estuary Program (NEP)
- US Geological Service (USGS)
- National Oceanographic & Atmospheric Administration (NOAA)
- State Departments of Natural Resources, Ecology, Environment, etc. State Programs. Including Probabilistic Monitoring Design Status
- Puget Sound Ambient Monitoring Program (PSAMP)
- Native American Tribal Governments and Tribal Programs

Environmental Monitoring and Assessment Program (EMAP)

The United States Environmental Protection Agency promoted the creation of the Environmental Monitoring and Assessment Program (EMAP). EMAP was intended to provide policy makers with information on the state of U.S. ecological domains through a complex scientific sampling scheme. The effort was finally abandoned, in part because, even in principal, it would only provide information at a very high cost. Equally, however, it became clear that EMAP would probably never provide useful information to decision-makers--local or national. EMAP was a classic case of a monitoring system designed by scientists for scientific purposes and lacking a clear connection to policy-relevant issues (UNEP, 2000).

Water Quality program

The US Environmental Protection Agency has created an exemplary observing system for national water quality by building up from local and state water quality monitoring systems. The US EPA helps localities to define issues and set up systems to meet their own needs; at the same time, it also sets standards and harmonizes systems. It assembles local information--indeed, many states use the EPA Office of Water Internet site to disseminate their own findings--makes it publicly available, and uses it to analyze national water quality issues including a national indicator map of water quality and vulnerability.

The Internet site also makes available access to other databases that are relevant to understanding water issues in each watershed and for the nation as a whole. These databases include air quality, water use and availability, population, and agency jurisdictions. The power of this observing system is that it builds from, and includes, all data that are collected and considered relevant by local policy makers and managers. Even though the provision of the data is mandated by law, the system rewards cooperating institutions by publishing the data in a common form, providing comparisons across space and time, and giving local information a national context and a national purpose alongside local and state purposes (UNEP, 2000).

Regulatory monitoring in the marine environment

In the U.S., regulatory monitoring in the marine environment is mandated by a variety of local, state, and federal statutes including the Federal Water Pollution Control Act; the Marine Protection, Research and Sanctuaries Act; the Outer Continental Shelf Lands Act; and the National Ocean Pollution Research, Development and Monitoring Planning Act. Federal Agencies responsible for these various programs include the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Army Corps of Engineers (COE), and the Minerals Management Service (MMS) of the Department of the Interior. Numerous state agencies, local authorities, utilities, and industries that discharge materials into coastal ocean waters are also required to conduct marine environmental monitoring programs.

One of the programs is the National Coastal Condition Reporting. The reports describe the ecological and environmental conditions in U.S. coastal waters. They summarize the condition of ecological resources in the coastal waters of the United States and highlight several exemplary federal, state, tribal, and local programs that assess coastal ecological and water quality conditions. Preparation of these reports represents a coordinated effort among the EPA, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey, the U.S. Fish and Wildlife Service, coastal states, and the National Estuary Programs.

Another example of the coordinated multi-agency activities is the Rocky Intertidal Network Monitoring Program (Engle, 2008). Periodic monitoring of the condition and dynamics of rocky shore marine life is critical for detecting and understanding community dynamics in order to develop management measures to anticipate and reduce acute or chronic environmental impacts. Goals of long-term rocky intertidal monitoring include maintaining an historical perspective of important resources, documenting the effects of long-term climatic changes, enhance understanding of the extent of temporal variation in natural systems, determining compliance with standards or regulations, providing an early warning of abnormal conditions, assessing and reducing environmental impacts, identifying trends that may reflect cumulative impacts, guiding development and evaluation of impact mitigation measures, providing information to assist in natural resource damage assessments.

National system of marine protected areas (MPAs)

Presidential Executive Order 13158 of 2000 provided authority for the development of a National System of MPAs within the EEZ of the three oceans that

border the USA (Pacific, Atlantic, Arctic) and the Great Lakes. The National Marine Protected Areas Center (MPA Center) is responsible for its implementation. The USA currently has some 2000 MPAs according to the IUCN definition, but these are

not representative, do not form an ecologically representative network and only a small proportion (less than 1%) of the total area is no-take (such as in Buck Island Reef and Virgin Islands Coral Reef National Monuments, Channel Island National Park, and Dry Tortugas National Park).

Research and monitoring conducted in and around marine reserves and protected areas have three primary and interrelated benefits: (1) better understanding of reserves—how they should be designed and what their benefits and costs are in ecological and socioeconomic terms; (2) deeper knowledge of complex marine ecosystems and the ways that human activities affect these systems; and (3) development and application of marine management methods that are cost-effective in achieving specific goals.

Monitoring is an integral component of marine area management; it provides the data required to evaluate changes in marine ecosystems as a result of the implementation of MPAs, especially areas zoned as ecological or fishery reserves. These evaluations are essential for determining effectiveness, improving design, and providing progress reports to stakeholders. Monitoring refers to the periodic evaluation of specific attributes of the ecosystem(s) and socioeconomic conditions represented in or relevant to MPAs.

4.5. Monitoring of oceans in Canada

In 1997, Canada became the first country in the world to adopt comprehensive legislation for oceans management. By passing its Oceans Act, Canada made a legal commitment to conserve, protect and develop the oceans in a sustainable manner. Key Legislation and Strategies are:

1997 — Canada’s Oceans Act

2002 — Canada’s Oceans Strategy

2005 — Canada’s Oceans Action Plan

2007 — Health of the Oceans Initiatives

2009 — Our oceans, our future: Federal programs and activities

Canada’s Oceans Act

Canada’s Oceans Act is founded on three principles of sustainable development, integrated management, and the precautionary approach, legally

defines Canada's ocean boundaries, promotes an integrated oceans management approach (i.e. a collaborative process that brings together interested parties), encourages government-wide collaboration and coordination, and respect for jurisdictional authorities, engages all Canadians interested in making decisions that affect them and their ocean environment; and assigns federal responsibility to the Minister of Fisheries and Oceans Canada for new and emerging ocean-related activities not previously assigned by Parliament.

Canada's Oceans Strategy

In 2002, Canada released its Oceans Strategy outlining the government's vision and direction for modern oceans governance. The overarching goal of the strategy is ensuring healthy, safe and prosperous oceans for the benefit of current and future generations of Canadians. As called upon by Canada's Oceans Act, development and implementation of the Oceans Strategy — built on several years of operational experience — are led by the Minister of Fisheries and Oceans Canada (DFO).

Canada's Oceans Strategy commits the Government of Canada to fundamentally change the way the oceans are used and managed. This is accomplished by providing policy direction for an integrated approach to oceans management, calling for coordination of policies and programs within and across governments, and advocating an ecosystem approach to ocean resource management and environmental assessment.

Canada's Oceans Action Plan

In May 2005, Canada announced its Oceans Action Plan. This plan enabled government-wide action to develop Canada's ocean resources for the benefit of coastal communities, while protecting fragile marine ecosystems. The Oceans Action Plan acts as a framework for an integrated federal oceans agenda. The plan includes 18 initiatives across six federal departments (DFO, Environment Canada, Health Canada etc).

Oceans management approach

Integrated management is a modern approach to managing Canada's ocean resources. It is a collaborative way of making decisions on how Canada's marine resources can best be developed and protected. The overall purpose of integrated management is for decision makers responsible for ocean-based activities to manage these activities in a manner that will sustain a healthy marine environment and provide due consideration of other ocean users. The aim of integrated management is

to improve decision making to ensure that decisions are more effective in the long term, not conflicting, built upon a common knowledge base, and take into consideration the needs of the ecosystem as well as the needs of humankind. An important goal is to promote co-operation with the international partners.

The Government of Canada is using a modern and coordinated approach to manage the impact of human activities on Canada’s oceans in a sustainable manner, creating a balance between protecting marine ecosystems and maintaining a prosperous economy. Federal, provincial and territorial governments and Aboriginal peoples play a role in managing the country’s oceans. The Government of Canada has established five Large Ocean Management Areas (LOMAs) where integrated oceans management plans are being developed for the management of each of these ocean areas. More LOMAs should be identified in the future to ensure integrated oceans management plans are in place for all of Canada's ocean areas.

These LOMAs are typically thousands of square kilometers in size, with boundaries determined using a combination of ecological and administrative considerations. The scientific and planning work conducted within an individual LOMA will help decision makers responsible for ocean activities to plan and manage human activities in a comprehensive manner, while considering all measures necessary for the conservation, protection and sustainable use of ocean resources and the shared use of ocean areas.

Health of the Oceans Initiatives

In 2007, building on the successes of its Oceans Action Plan, Canada announced five-year funding to improve the health of the oceans as part of its new National Water Strategy. These funds advances several distinct initiatives to be conducted by five federal departments and agencies that work closely with others to protect fragile marine environments, counter pollution and strengthen preventive measures. The Initiatives aim at strengthening pollution prevention at source (conservation of natural resources), increasing capacity to lessen the effects of pollution when and where it occurs, increasing protection of ecologically significant marine areas through the establishment of nine new marine protected areas (MPAs), investing in science to better understand the oceans; and co-operating more closely with domestic and international partners for more integrated oceans management.

Canada's network of marine protected areas

Marine protected areas have a critical role to play in the protection and conservation of Canada's rich and varied marine environments. The Oceans Act tasks

the Minister of Fisheries and Oceans with a leadership and coordination role for the development and implementation of a national network of marine protected areas on behalf of the Government of Canada. Federal marine protected area legislated authorities are committed to working with provincial and territorial counterparts, Aboriginal groups, industry, academia and environmental non-governmental organizations to build a national network of marine protected areas that protects key marine habitats, species and features that are ecologically significant and vulnerable.

Canada's federal marine protected areas network is comprised of three core programs:

- Marine Protected Areas established by Fisheries and Oceans Canada under the Oceans Act to protect and conserve important fish and marine mammal habitats, endangered marine species, unique features and areas of high biological productivity or biodiversity.
- Marine Wildlife Areas established by Environment Canada to protect and conserve habitat for a variety of wildlife, including migratory birds and endangered species.
- National Marine Conservation Areas established by Parks Canada to protect and conserve representative examples of Canada's natural and cultural marine heritage, and to provide opportunities for public education and enjoyment.

In addition to these core marine protected areas programs, migratory bird sanctuaries, national wildlife areas and national parks with a marine component are also important contributions to the marine protected areas network.

The Federal Marine Protected Areas Strategy outlines how these departments and agencies should work together to establish federal marine protected areas within the context of integrated oceans management that will protect and conserve Canada's natural and cultural marine resources.

National aerial surveillance program

The National Aerial Surveillance Program (NASP) is one of the main pillars of Transport Canada's Pollution Prevention Program. The NASP was established in 1991 to detect pollution violations and enforce international conventions and domestic legislation. The program conducts aerial surveillance over all waters under Canadian jurisdiction by using four patrol aircraft, which are strategically placed across Canada. Since assuming control of the program in 2003, Transport Canada has doubled the number of patrol hours, expanded to areas not previously patrolled (such

as the Arctic and the Labrador Coast) and acquired maritime surveillance equipment, for the surveillance aircraft, ideally suited for detecting oil pollution from ships.

4.6. Marine monitoring in Australia

The marine environment is governed by a complex array of legislative and institutional arrangements from local, state, national and international in Australia. Commonwealth legislation includes the Environmental Protection (1986) and Biodiversity Conservation Act (1999) and the Great Barrier Reef Marine Park Act (1975) (the latter affects Queensland only). Other Commonwealth legislation that may be relevant includes the Native Title Act (1993) that may affect the use of public land and waters. The Environmental Protection Authority was established under the Environmental Protection Act 1986. The Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Examples how marine monitoring is organized in three states of Australia are provided below.

Reef Rescue Marine Monitoring Program (MMP) http://www.rrrc.org.au/mmp/

The Reef Water Quality Protection Plan (RWQPP or 'Reef Plan') was released by the Australian and Queensland Governments in October 2003. The Reef Plan focused on identifying and implementing solutions to improve water quality through sustainable natural resource management, with the ultimate goal to 'halt and reverse the decline in water quality entering the Great Barrier Reef within ten years'. As part of the Reef Plan, the RWQPP Marine Monitoring Program was established in 2005, funded by the Australian Government and managed by the Great Barrier Reef Marine Park Authority.

In 2008, the new Federal Government committed $200 million to a five-year Reef Rescue Plan - a comprehensive program to tackle climate change and to improve water quality in the Great Barrier Reef. The Reef Rescue Plan is a key component of *Caring for our Country*, the Australian Government's $2.25 billion initiative to restore the health of Australia's environment and improve land management practices. The Reef Rescue Plan represents a new, coordinated approach to environmental management in Australia that is built on transparent and consistent national targets. Through the Reef Rescue Plan, $22 million has been allocated for a Water Quality Monitoring and Reporting Program to expand existing efforts and to

continue the already established RWQPP Marine Monitoring Program. In 2008/2009 the Marine Monitoring Program is supported through Reef Rescue and is now known as the Reef Rescue Marine Monitoring Program. The Program is a critical component of the assessment of any long-term improvement in regional water quality that will occur as best practice land management is widely adopted across the catchments feeding into the Great Barrier Reef.

The Reef Rescue Marine Monitoring Program assesses the health of key marine ecosystems - inshore coral reefs and intertidal seagrasses - and the condition of water quality in the inshore Great Barrier Reef lagoon. The monitoring program has been developed using the best available science and is continuously improved with the advancement of scientific understanding. Through the Reef and Rainforest Research Centre, the Reef Rescue Marine Monitoring Program is strongly linked to the Australian Government's Marine and Tropical Sciences Research Facility, through which indicators and technologies can be operationalized.

In 2007/2008, the Marine Monitoring Program involved two core programs and seven sub-programs:

- **Inshore biological modeling:** (a) Inshore coral reef monitoring; (b) Intertidal seagrass monitoring; (c) Assessing light as a driver of change in seagrasses of the Great Barrier Reef; and
- **Water quality monitoring:** (d) Inshore marine water quality monitoring; (e) Floodplume water quality monitoring; (f) Inshore and river pesticide monitoring; (g) Remote sensing of water quality in the Great Barrier Reef.

The Western Australian Marine Monitoring Program

Marine parks and reserves in Western Australia are managed by the Department of Environment and Conservation (DEC). The Western Australian Marine Monitoring Program has been developed in DEC to progressively implement and document strategic and integrated monitoring within WA's marine protected areas and for threatened marine fauna statewide. The program adopts a Condition-Pressure-Response (CPR) approach within an adaptive management context and will be delivered primarily through a partnership approach between the Marine Science Program and the Regional Services Division of DEC. Collaborations will also be sought with specialist branches within DEC, other agencies such as the Department of Fisheries, CSIRO and AIMS, local universities, industry and NRM and community groups. The implementation of an integrated and coordinated marine monitoring program will ensure that clear trends on the condition of assets outlined in marine

protected area and threatened marine fauna management plans will be available to DEC managers, local and wider community groups and industry. In addition, trends of the human pressures and the effectiveness of management responses will also be made available (Sutton & Friedman 2009; Friedman 2009).

Marine Parks Authority of New South Wales

New South Wales (NSW) is committed by national and international agreements to conserving the diversity of marine life and ensuring that marine resources are carefully managed for the use and enjoyment of people today and in the future. The Marine Parks Authority helps NSW to meet these commitments by selecting areas for protection as marine parks, and managing the established marine parks in a way that balances marine conservation needs with recreational and commercial interests. The NSW system of marine protected areas encompasses six multiple use marine parks, 12 aquatic reserves and 62 national parks and reserves with marine components.

The Marine Parks Strategic Research Framework 2010-2015 sets the direction for research and monitoring in NSW marine parks. The Framework coordinates the research and monitoring done by partner agencies in NSW, provides guidance to the marine research community on the principal research and monitoring needs that need to be addressed for effective management of marine parks in NSW, shows current, proposed and anticipated research projects for 2010–2015, including continued support for the comprehensive habitat mapping program, increases the focus on system-wide research such as using Baited Remote Underwater Video, and increases support for social and economic research. The Framework identifies 30 research activities which will be conducted by the Marine Parks Authority, receive significant funding and operational support from the Authority, or are important components of research into marine parks which are part of the whole of government approach to marine biodiversity conservation and will be led by other agencies.

The Framework was developed through the advice of the Marine Parks Advisory Council, local marine park advisory committees and the annual Marine Parks Authority research planning workshop which involves marine park scientists, scientific representatives on the Advisory Council and Advisory Committees, additional researchers active in marine parks and representatives from the Department of Environment, Climate Change and Water, Industry and Investment NSW and other relevant state government agencies.

Australian Maritime Safety Authority (Protecting our seas, 2010)

In the event of oil or chemical pollution, Australia has a national pollution contingency plan and response capability, known as the National Plan to Combat Pollution of the Sea by Oil and other Noxious and Hazardous Substances. Australia supports a policy of on-board adherence to pollution conventions. Enforcement activity is two-fold through port State Control inspections and investigations following reports of pollution incidents. Pollution surveillance operations are coordinated by AMSA in Canberra through the Australian Search and Rescue Centre. Reports originate from many sources including Border Protection Command, Coastwatch, the shipping industry, civil and military aircraft and the general public.

4.7. Global observing systems

Global Ocean Observing System (GOOS)

GOOS is designed and being implemented to embrace the oceans as a single entity, to provide a global view of the ocean system. It is a permanent global system for observations, modeling and analysis of marine and ocean variables to support operational ocean services worldwide. GOOS provides accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible, and the basis for forecasts of climate change.

GOOS is a system of programs, each of which is working on different and complementary aspects of establishing an operational ocean observation capability for all of the world's nations. UN sponsorship and UNESCO assemblies assure that international cooperation is always the first priority of the Global Ocean Observing System. GOOS is the oceanographic component of GEOSS, the Global Earth Observing System of Systems.

GOOS serves oceanographic researchers, coastal managers, parties to international conventions, national meteorological and oceanographic agencies, hydrographic offices, marine and coastal industries, policy makers and the interested general public.

GOOS is made of many observation platforms and is implemented by member states via their government agencies, navies and oceanographic research institutions working together in a wide range of thematic panels and regional alliances (e.g. EuroGOOS etc.).

UNEP Global Environment Monitoring System (GEMS)

Initially, GEMS focused on developing monitoring methodologies, establishing quality control systems and global databases, capacity building and technical support, and the production of status and trends overviews in specific environmental compartments. Some of these assessments, such as on Ozone, contributed directly to the launching of international environmental conventions.

GEMS programs were implemented through and with sister organizations in the UN system. This respected the intent of UNEP's mandated role to catalyze, coordinate and promote routine environmental observing in a large number of countries and by UN organizations. They were instrumental in driving world-wide observing and assessment and promoting their incorporation in UN programmes. However, they only covered a limited number of environmental sectors/themes such as freshwater quality, urban air pollution, and food contamination.

For over twenty years the Fresh Water Component of the ***Global Environmental Monitoring Program*** (GEMS/Water) has been operating as the resource water quality monitoring and assessment arm of the UNEP. Their offices are situated at the National Water Research Institute in Burlington, Canada. The primary means by which GEMS/Water has been able to achieve its international position has been and continues to be, the direct interaction with key agencies and individuals in each participating country worldwide. By establishing a network of countries contributing data from national water quality monitoring programs, GEMS/Water has built a global water quality database for rivers and lakes. Since 1998 the number of participating countries has increased to 101.

Monitoring programs in participating countries contribute to approximately 700 stations worldwide. Data are stored in the GEMS/Water global database called GLOWDAT from where it is transmitted to various UN and other agencies for use in global sustainability reports. In partnership with the Global Runoff Data Centre (GRDC) in Germany, GEMS/Water has created a single port of entry for global water quality and quantity data requests from a large number of UN and other agencies.

Lessons learnt from the experience in observing systems

UNEP's review of international observing systems (2000) has indicated that observing systems designed to support global purposes seem to work best when they also serve local and/or national purposes; that is, they are built on the back of local/national systems and add value by aggregating and summarizing data in a global context, and they return something to the local/national entities that are the source of the data, usually information that provides geographical context or is based

on more detailed analysis, but also sometimes standards, training or other forms of capacity building, or direct financial support. Purely global systems that have dense enough networks to be useful are rare, and the available evidence suggests that adequate financial resources to support global networks are unlikely to be sustained unless the networks also serve local/national needs.

The review has highlighted that observing systems that provide specific information products in a form useful to decision-makers seem to be far more successful than those that simply collect and make available data. The review has showed that the greater the variety of information products provided and audiences served, the more robust the support for the observing system and the greater its success. The World Weather Watch and the televised daily weather maps are the classic example. Thus analysis and simplification or visualization--the process of turning data into information, into products useful to decision-makers--is a critical component of successful observing efforts.

The review has concluded on the basis of the analysis done that most older global monitoring systems were designed around a centralized database and management; in the Internet age, distributed databases are equally feasible and may fit better with the concept of broad participation and ownership in a monitoring system. For instance, a more bottom-up approach that helps to ensure the system also serves local/national needs. The reviewers advised to make a combination of the two types where appropriate. Centrally-coordinated systems can provide sampling frameworks, classifications and global models, and feedback results in a wider context. Local networks spread ownership and involvement, and can provide unique types of information to be cross-checked with more standard sources.

Chapter 5. Prospects of international cooperation in the field of environmental monitoring of the Caspian Sea

5.1. Organization of environmental monitoring of the Caspian Sea in the Caspian littoral states

In the Soviet period monitoring of the state and pollution of the Caspian Sea with the exception of the water area adjacent to the Iranian coast was performed by Goskomhydromet according to OGSNK (State Monitoring and Control Service) Programme. Alongside with it Ministry for Fishery carried out regular fishery research covering almost all the water area of the sea. There was no legislative background of environmental monitoring; observations of the state of the natural environment were organized in accordance with legal-regulatory acts of executive agencies, aimed at nature protection. Regulatory and procedural background of marine monitoring included the state standard regulating the control of marine water quality, recommendations on the complex assessment of marine water quality by hydrochemical parameters and the list of maximum permissible concentrations of pollutants in the marine water.

What changes have happened to environmental monitoring of the Caspian Sea since the Caspian littoral Soviet republics became independent states? In our opinion, *practical* changes and the changes in the *institutional and legal frameworks* should be considered separately. The following main changes occurred in practical field:

- in the 90s the observations within the state monitoring were stopped and/or the volume of observations was reduced;
- in the beginning of the 90s the observations at latitude century cross-sections of the Middle and South Caspian (from eastern to western coast) were stopped;
- the area covered by full-scale fishery observations reduced;
- resource users (oil and gas companies mainly) started to perform industrial (local) environmental monitoring;
- the list of controlled parameters of marine water and bottom sediments pollution was extended by adding persistent organic pollutants and heavy metals.

At the same time it should be noted that no sufficient reduction of observations of the state and pollution of coastal areas was registered (in some sectors the scope of observations decreased, in some sectors it increased). It is interesting to note that the normative - methodical basis for marine monitoring did not change much. Moreover, the Caspian states which are members of the Commonwealth of Independent States

(CIS) still use the mentioned above Soviet standards, including the list of MPCs (in Russia it was revised several times, the last revision being in 2010)[26].

Sufficient, or even fundamental changes occurred in the institutional and legal frameworks of environmental monitoring, including the environmental monitoring of the Caspian Sea (table 4.1). The definition of environmental monitoring and its types appeared in the national laws and codes, and in most cases governmental agencies authorized to implement the monitoring were determined. In some countries (Azerbaijan, Kazakhstan, Turkmenistan) environmental monitoring of the Caspian Sea is considered as an independent type of environmental monitoring, in other (Russia, Iran) - as a combination of different types of monitoring. In Russia and Kazakhstan the monitoring of state and pollution of the marine environment of the Caspian Sea (as in the Soviet period) is carried out by national hydrometeorological services (these services are included in the nature protection agencies). In Azerbaijan and Turkmenistan special services for implementing environmental monitoring were established; they are subordinate to the nature protection agencies.

Table 5.1

Legal and institutional characteristics of the organization of the environmental monitoring (EM) including the monitoring of the Caspian Sea (CS) in the Caspian littoral states

Organizational aspects	The Caspian Littoral States:				
	Azerbaijan	Iran	Kazakhstan	Russia	Turkmenistan
Definition of EM and authorities for its implementation in the national laws	+	–	+	+	+
Differentiation of EM types by environmental components	+	+	+	+	+
Integration of EM different types in the EM unified national system*	–	–	+	+	–

[26] We can't but mention the sanitary and hygienic monitoring of coastal sea water in water consumption areas which is usually not included in the environmental monitoring, but is a good addition to it (in particular, the data of sanitary-biological surveys make it possible to assess the pollution of marine water area with domestic waste water). Sanitary and hygienic monitoring of coastal sea water was launched in the Soviet period and is still implemented.

Organization and implementation of CS monitoring as an EM independent type	+	–	+**	–	+
Organization and implementation of marine monitoring, including the CS as a combination of EM different types	–	+	–	+	–
Implementation of CS monitoring by one state institution	+	–	–	–	+
Implementation of CS monitoring by different state institutions	–	+	+	+	–
Participation of resource users in the CS environmental monitoring	+	–	+	+	+
Integration of different types and/or monitoring participants in the unified national system of the CS monitoring	–	–	–	+***	–

Note: *- only in conceptual and legal standards which are not realized; **- only in respect of the protected area in the northern part of the Caspian Sea, ***- ideologically only

Some words must be said about the organization of environmental monitoring of the Caspian Sea in the Islamic Republic of Iran, which resembles that of the Russian Federation, though these systems are not at all connected with each other historically. It might be conditioned by the fact that of all the Caspian littoral states only Russia and Iran have access to other seas. Regular studies of the Caspian Sea are held by the Department of Environment, subordinate to the IRI President, Organization of Fishery Research under the Ministry of Agriculture, Metrological Organization under the Ministry of Roads and Transport and Caspian Sea National Research Centre of the Water Research Institute under the Ministry of Energy.

The institutional and legal framework of the environmental monitoring of the Caspian Sea is the most complicated (requiring simplification) in the Russian Federation.(see Chapter 1). However environmental monitoring of the Caspian Sea in other Caspian littoral states includes several types and/or is implemented by several organizations (including resource users). Therefore the common problem for all the Caspian states is the integration of different types and/or participants of monitoring into unified national systems of the Caspian Sea monitoring.

Solution of this problem is important not only from the point of increased efficiency of monitoring. It is also a prerequisite for cooperation of the Caspian states in the field of the Caspian Sea monitoring, as far as international integration can't be reached without integration at national level (this rule concerns all the spheres of state activities).

5.2. Organization of joint activities of the Caspian states in the field of environmental monitoring of the Caspian Sea

In 2003 in Tehran the Caspian littoral states signed the Framework Convention for the Protection of the Marine Environment of the Caspian Sea which came into force in 2006. In accordance with Article 19 of the Tehran Convention, the Caspian littoral states:

- endeavour to establish and implement individual and/or joint programmes for monitoring environmental conditions of the Caspian Sea.
- agree upon a list and parameters of pollutants which discharge into and concentration in the Caspian Sea shall be regularly monitored.
- at regular intervals, carry out individual or joint assessments of the environmental conditions of the Caspian Sea and the effectiveness of measures taken for the prevention, control and reduction of pollution of the marine environment of the Caspian Sea.
- endeavour to harmonise rules for the setting up and operation of monitoring programmes, measurement systems, analytical techniques, data processing and evaluation procedures for data quality.
- develop a centralised database and information management system to function as a repository of all relevant data, serve as the basis for decision-making and as a general source of information and education for specialists, administrators and the general public.

A background for joint activities of the Caspian states in the field of the Caspian Sea environmental monitoring has been established within the framework of Caspian Environmental Programme and CASPECO project (further referred to as CEP/CASPECO) with the support of such international organizations as Global Environmental Fund (GEF) and UN Programme for Environment Protection (UNEP). Several joint expeditions have been implemented. As a result, prevailing pollutants and "hot spots" were identified. The state of observation networks and institutional-legal aspects of monitoring in all the Caspian littoral states have been analysed (these materials were used in the preparation of Section 4.1). The efforts of national and international experts resulted in the draft of the joint programme of observations of the state and pollution of the marine environment.

The joint activities of the Caspian states in the field of environmental monitoring of the Caspian Sea in our opinion should develop step-by-step. The main attention at the first stage must be paid to the cooperation of national systems of the Caspian Sea monitoring, establishment of joint agencies focused on the implementation of main monitoring functions.

In this case we are talking not about the external functions implemented by monitoring in nature protection and other fields (covered in the introduction), but about the internal functions reflecting different aspects of activities in the field of environmental monitoring. The internal functions of the joint environmental monitoring of the Caspian Sea include:

- observations of marine environment conditions in the coastal area;
- ensuring uniformity of measurements and data quality control;
- receipt and analysis of satellite data on the condition of the Caspian Sea water area;
- collection, processing, storage and distribution of observation data;
- regular assessment of the state of marine environment;
- interaction with executive bodies of the Tehran Convention, public awareness raising.

As far as external functions of the joint environmental monitoring are concerned, we consider evaluating function as the most important one. This type of monitoring differs from the monitoring implemented at the national level. State environmental monitoring of marine water areas is currently focused on implementing the notifying function (which is expected to give place to the instructive function), and the main function of the environmental monitoring performed by resource users is the controlling function.

In accordance with the ideas expressed above we have elaborated two drafts of "Guidelines for the first stage of the joint programme of the monitoring of the Caspian Sea marine environment". In the first variant (which follows) the functions on joint environmental monitoring of the Caspian Sea are distributed among the Caspian states. In the second variant (presented in Annex 5), these functions are distributed among Working groups formed by representatives of all the Caspian states.

Guidelines for the first stage of the joint programme of the monitoring of the Caspian Sea marine environment (Draft 1)

Introduction

In accordance with the Framework Convention for the Protection of the Marine Environment of the Caspian Sea, hereinafter named as the Convention, the Caspian littoral states "shall endeavour to establish and implement *individual* and/or *joint* programmes for monitoring environmental conditions of the Caspian Sea" (Article 19, item 1).

Since the time the Convention was signed, the Caspian states have made a sufficient progress in the elaboration of *individual* (national) monitoring programmes through using new observation methods and tools, developing information systems and improving the assessment of marine environment conditions.

At the same time the variety of marine environmental monitoring types has increased at the national level as well as the number of organizations taking part in it; and the differences between national environmental monitoring systems have become deeper at the regional level.

Taking the abovementioned into account, the implementation of the *joint* (regional) programme and the solution of other tasks related to marine environmental monitoring indicated in Article 19 of the Convention, should be started with the establishment and launch of cooperation mechanisms at national and regional levels, or, in other words, with the establishment of common background for individual programmes.

Cooperation mechanisms have been elaborated within the framework of different projects implemented throughout 1998 - 2011 under the guidance of CEP and CASPECO and supported by UNEP, UNDP, GEF and TACIS. In doing this, the Caspian littoral states have gained unrivalled cooperation experience in monitoring of the Caspian Sea marine environment .

Currently these ideas are reflected in the draft "Guidelines for the first stage of

the joint programme of the monitoring of the Caspian Sea marine environment" which is expected to be adopted at the next Conference of Parties to the Tehran Convention. Main statements of this document are listed below.

1. GENERAL PROVISIONS

The main cooperation mechanism at the regional level is the even distribution among the Caspian littoral states of the functions related to the joint activities in the field of marine environmental monitoring, such as carrying out joint observation and maintaining a centralized database (these functions are hereinafter referred to as *cooperative functions*).

At the first stage the cooperative functions will be implemented through international and individual assistance and through involving national resources of the Caspian states; *further on* these functions will be mainly implemented by means of national resources (human, material and financial ones).

To save resources and systematize various types of monitoring implemented at the national level it is advisable to establish National Coordinating Centres of the Caspian Sea monitoring in all the Caspian states using the facilities of organizations involved in its implementation and to delegate these Centres with authorities for implementing cooperative functions.

The activities of National Coordinating Centres at the regional level will be coordinated by Coordinating Bureau of the Joint Programme for monitoring of the Caspian Sea marine environment (hereinafter referred to as Coordinating Bureau), which functions will be performed at the first stage by the Secretariat of the Convention.

These Guidelines set a list of cooperative functions and their distribution among the Caspian states as well as the main requirements to implementing these functions at the first stage of the Joint Programme for monitoring of the Caspian Sea marine environment.

Throughout the 1st stage detailed guidelines for implementing separate cooperative functions will be elaborated on the basis of the acquired experience; further on these guidelines will be joined in one single document.

Joint activities in the field of the Caspian Sea environmental monitoring at the first stage will be planned and implemented by the Coordinating Bureau taking into account the received international and individual assistance and the allotted national resources of the Caspian littoral states.

2. Cooperative functions in the field of monitoring of the Caspian Sea marine environment and their distribution among the Caspian states.

Cooperative functions in the field of monitoring of the Caspian Sea marine environment	Caspian states
Carrying out observations of the marine environmental conditions in the coastal water area	*Each of the Caspian states*
Ensuring measurements uniformity and data quality control	*Islamic Republic of Iran*
Receipt and analysis of satellite data on the condition of the Caspian Sea water area	*Republic of Kazakhstan*
Collection, processing, storage and distribution of observation data	*Republic of Azerbaijan*
Regular assessment of marine environment condition	*Russian Federation*
Interaction with executive agencies and the Convention protocols Public awareness raising	*Turkmenistan*

3. Main requirements to performing cooperative functions in the field of monitoring of the Caspian Sea marine environment and their distribution among the Caspian states.

3.1. Carrying out observations of the marine environmental conditions in the coastal water area

Each Caspian state selects at least 10 stations used for joint programmes of marine environment observations where observations will be carried out in accordance with these Guidelines. The stations selected by all the Caspian states make up a *joint observation network (JON).*

The JON stations are located at the depth of at least 5 metres in the North Caspian and at the depth of at least 10 metres in the Middle and in the South Caspian. The total number of stations is evenly distributed among the following *areas:* a) river estuaries; b) roadsteads of sea ports and big cities (with population of at least 50 thousand); c) areas of marine oil and gas blocks prospecting and development; d) recreational areas; e) areas with minimal anthropogenic load on the water area. In addition, the stations located in one area should differ from each other in hydrological

and lithological conditions.

Observations at JON stations are carried out at least twice a year: in spring (April - May) and in autumn (October - November), simultaneously with the observations carried out in accordance with individual monitoring programmes. Observations are carried out during the summer season as well if possible. Observations are made in the daylight under favourable hydrometeorological conditions.

The following measurements are made at every station: air temperature and humidity, wind speed and direction, wave height, period and direction, transparency and colour. Hydrological probes are used for measuring water temperature, electric conductivity and salinity in the surface and bottom layers. On-board observations include measurements of pH, concentrations of dissolved oxygen, mineral phosphor, nitrate and ammonium nitrogen, and dissolved silicon in water samples taken in the surface and bottom layers. The station coordinates, time and date of observations, sea depth and the results of meteorological, hydrological and hydrochemical observations are recorded in the special register.

Samples are taken at every station to determine: a) chlorophyll concentration, species composition, abundance and biomass of phytoplankton in the surface water layer; b) species composition, abundance and biomass of zooplankton in the water column from bottom to surface; c) species composition, abundance and biomass of zoobenthos.

Samples of suspended matter are taken at every station to carry out its chemical analysis and to measure its concentration in the surface and bottom water layers. In addition, samples of water (in the surface and bottom layers) and bottom sediments are taken to perform chemical analysis. Samples of bottom sediments are taken to determine their granulometric composition.

Samples of water and bottom sediments are analysed in coastal laboratories. A unified method is used to identify Fe, Mn, Zn, Ni, Cu, Pb, Cd and Hg in all the samples of water, suspended matter and bottom sediments. Concentrations of oil products[27], total nitrogen and phosphor are also measured in water samples; the content of organic carbon is measured in samples of suspended matter and bottom sediments. The content of main granulometric fractions, concentration of oil products, DDT and its metabolites and main HCCH isomers (α, β, γ) are determined in bottom sediments.

All observations, measurements, sampling and analyses in coastal labs are

[27] Oil products refer to substances extracted from samples of water and bottom sediments with help of non-polar solvents and going through activated aluminium oxide.

carried out in accordance with national practice, regulations and standards and the requirements to supporting unified measurement standards. The results of observations, measurements and analyses are submitted to the centralized database within a 3-month period.

3.2. Ensuring measurements uniformity and data quality control

Performing the cooperative function to provide measurements uniformity and data quality control, *the Islamic Republic of Iran*:

- maintains and supports the databases of a) organizations taking part in monitoring of the environmental conditions of the Caspian Sea at national level; b) stations of the joint observation network including the data on coordinates, depth, programme, date of observations launch, frequency and composition; c) methods and tools of observations and measurements used for monitoring of the environmental conditions of the Caspian Sea at national level;

- annually exercises interlaboratory calibration and external control of measurements quality (supplies the monitoring organizations with standard materials, analyses the received control results) and prepares annual report on methods, tools and quality of observations and measurements;

- creates and supports a special web site for access to databases and distribution of information on the joint observations network, and methods and quality of observations;

- elaborates "Guidelines for methods of monitoring environmental conditions of the Caspian Sea" in cooperation with other Caspian states using regional and international experience.

These guidelines are to provide for:

- the unification of methods and tools of observations carried out by the Caspian states within the joint observation network and within individual programmes;

- the increase of measured parameters of the marine environment, mainly by persistent organic pollutants;

- the use of biological methods (biotesting and bioindicators) to assess marine environment pollution.

All the Caspian states provide their assistance to the Islamic Republic of Iran in performing its cooperative function aimed at provision of measurements uniformity and data quality control.

3.3 Receipt and analysis of satellite data on the condition of the Caspian Sea water area

Performing cooperative function to receive and analyse satellite information

on the condition of the Caspian Sea water area, the *Republic of Kazakhstan:*

- provides for the receipt of satellite data on the sea level, temperature of the surface water layer, concentration of chlorophyll and suspended matter in the surface layer, number and area of oil spills in geographical regions and the whole sea water area;

- provides for the decoding of satellite data (using ship observations data if necessary), as well as processing and presenting these data with help of GIS technologies;

- establishes and maintains satellite data base and a special website for distributing satellite information on environmental conditions of the Caspian Sea among stakeholders and the community;

- elaborates "Guidelines for using satellite data for monitoring the Caspian Sea marine environment" in cooperation with other Caspian states using regional and international experience.

These Guidelines are to account for the increase in the number of the Caspian Sea parameters covered by satellite observations and introducing new techniques for using these data for the assessment of the environmental conditions of the Caspian Sea.

All the Caspian states provide their assistance to the Republic of Kazakhstan in performing its cooperative function on receipt and analysis of satellite data on the condition of the Caspian Sea water area

3.4 Collection, processing, storage and distribution of observation data

Performing the cooperative function for collection, processing, storage and distribution of observation data, *the Republic of Azerbaijan*:

- receives from the Caspian states observations data of environmental conditions of the Caspian Sea at the stations of the joint observations network and converts them into a unified format complying with international standards;

-stores data on electronic media, regularly updates database description (metadata) taking into account new data and provides processing and presenting of these data with help of GIS technologies;

- receives the data of meteorological and hydrological observations from hydrometeorological organizations of the Caspian states through Coordinating Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea (CASPCOM) and compiles them into the database of monitoring of the Caspian Sea marine environment;

- creates and regularly updates the digital atlas of the Caspian Sea on the basis of the available database, designs and supports a special website to provide access to

metadata, databases and the Caspian Sea atlas;

- elaborates "Guidelines for collection, transmission, processing, storage and distribution of observations data on environmental conditions of the Caspian Sea" in cooperation with other Caspian states using regional and international experience.

These guidelines are to provide for the unification of techniques used to collect, transmit, store and distribute the observations data on environmental conditions of the Caspian Sea and to integrate these techniques into a unified cycle.

All the Caspian states provide their assistance to the Republic of Azerbaijan in performing its cooperative function on collection, processing, storage and distribution of observation data on environmental conditions of the Caspian Sea.

3.5 Regular assessment of marine environment condition

Performing the cooperative function to perform regular assessment of the marine environment conditions, the Russian Federation:

- analyses and classifies observations data on environmental conditions of the Caspian Sea at the stations of the joint observation network, satellite data as well as the information on the Caspian Sea pollution from on-land sources received from the relevant Convention protocol;

- creates and maintains a database of national standards and methods used in the Caspian states to assess the pollution of the marine environment of the Caspian Sea;

- performs integrated assessment of pollution of the Caspian Sea marine environment using methods and standards applied by the Caspian states as well as methods and standards used for this purpose in other countries and in international experience;

- designs and supports a special website for accessing databases and distributing information on the assessment of the Caspian Sea environment pollution;

- elaborates "Guidelines for assessment of the Caspian Sea marine environment" in cooperation with other Caspian states using regional and international experience. These guidelines are to provide for the unification of standards and methods used for performing this assessment.

The *Russian Federation* jointly with other Caspian states prepares the report on the state of the marine environment of the Caspian Sea. Alongside with the integrated assessment of the marine environment pollution, the following information is used:

- other types of anthropogenic load (apart from pollution) on the water area of the Caspian Sea received from the Caspian states;

- changes of climate and water balance of the Caspian Sea, provided by CASPCOM;

- state of the Caspian Sea biodiversity received from the relevant Convention protocol;

- state of water biological resources of the Caspian Sea received from the Caspian states through relevant joint commission;

The report on the environmental conditions of the Caspian Sea issued by the Coordinating Bureau after its endorsement by all the Caspian states, is to determine main factors of anthropogenic load on the marine ecosystem indicating their location in time - space domain. These factors are ranged by the level of impact on the marine environment. In addition, security level of the Caspian Sea marine environment should be assessed in relation to every factor and to anthropogenic load in general.

All the Caspian states provide their assistance to the Russian Federation in performing its cooperative function aimed at assessment of marine environment condition.

3.6 Interaction with executive agencies and the Convention protocols Public awareness raising

Performing the cooperative function to provide interaction with the executive agencies and the Convention protocols and public awareness raising, *Turkmenistan*:

- in cooperation with National Coordinating Centres prepares information and analytical materials on the environmental conditions of the Caspian Sea and the state of joint activities aimed at their monitoring for executive agencies and the Convention protocols;

- maintains and supports the databases of a) higher educational institutions of the Caspian states, preparing specialists in the field of marine environmental monitoring; b) scientific and research organizations carrying out research of the Caspian Sea; c) national and international experts in the field of the Caspian Sea environmental monitoring; d) public organizations of the Caspian states and international public organizations which participate in the protection of the Caspian Sea marine environment and the electronic library of scientific, popular science and journalistic publications in this field;

- creates and supports the website of the joint programme of the Caspian Sea marine environmental monitoring and displays the created databases and the guide on information resources in the field of the Caspian Sea environmental monitoring and prepares communications for the mass media covering the related events;

- elaborates "Guidelines for interaction with executive agencies and the Convention protocols on monitoring of the Caspian Sea marine environment and raising public awareness on its condition" in cooperation with other Caspian states using regional and international experience.

All the Caspian states provide their assistance to Turkmenistan in performing its cooperative function aimed at provision of interaction with executive agencies and the Convention protocols and public awareness raising.

4. Final provisions

The first stage of the Joint Monitoring Programme of the Caspian Sea environmental monitoring starts with the adoption of these Guidelines at the conference of the Convention parties.

The first stage of the Joint Monitoring Programme of the Caspian Sea environmental monitoring completes with the adoption of the complete Guidelines for marine environmental monitoring at the conference of the Convention parties, which means the full-scale implementation of these guidelines.

The complete guidelines are made up by the Coordinating Bureau on the basis of separate guidelines for performing cooperative functions in the field of Caspian Sea environmental monitoring elaborated by the Caspian states.

Conclusion

In conclusion we would like to turn back to the ideas expressed in the Introduction to this book, to be more exact - to the mission of environmental monitoring. Does environmental monitoring of the Caspian Sea cope with its mission? What must be done for the mission to be accomplished? These are two questions we are going to answer.

Let us dwell on the five basic functions of the monitoring (notifying, diagnostic, evaluative, controlling and instructive) taking into account the fact that the environmental monitoring of the Caspian Sea implemented in the RF is a combination of three types of environmental monitoring, two of which belong to the subsystems of the Unified State System of State Environmental Monitoring, and the third one is implemented by resource users.

The paper shows that the *notifying function* is properly implemented only by the subsystem of monitoring of state and pollution of the environment, but the range of parameters covered by this monitoring is rather narrow. The results of monitoring of water biological resources and the monitoring implemented by resource users are submitted only to federal agencies (Rosrybolovstvo and Rosprirodnadzor respectively). This does not mean that they are a "top secret", as they are published in special scientific papers, but they are not covered at the federal level because of their local nature. There are no mechanisms of information collection, processing and distribution at the territorial and regional level where this information is in demand.

What can we say about the processes currently ongoing in the Caspian Sea, their reasons and consequences? Is the Caspian Sea exposed to eutrophication? What is the reason of the recent sprat mortality, when a third of the sprat stock disappeared? How did intruder species (Rhizosolenia, Modiolus, Balanus, Mnemiopsis etc.) having occupied main ecological niches of the marine ecosystem affect its functional state? The absence of answers to these questions means that environmental monitoring of the Caspian Sea does not cope with its *diagnostic function*. One of the main reasons is the disunity of the monitoring of the state of marine environment and monitoring of water biological resources. It doesn't make it possible to trace the connection between the state of the marine environment and the state of biological resources.

At first sight the implementation of *evaluative function* is more or less successful. But quality assessment is performed only for hydrochemical parameters of the marine water using an outdated technique (adopted 25 years ago, it uses only 4 indicators) and MPCs unified for all the seas. Inexplicable cases of mass mortality of

seals and the "ecological paradox" of the North Caspian (fish inhabiting "clean" water are struck by toxicosis) point to the fact that environmental monitoring hardly copes with its mission of marine environment quality assessment. One of the reasons is the disunity between the monitoring of marine environmental pollution and the monitoring of water biological resources, which hampers establishing biological consequences of marine pollution and develop regional (applicable to the Caspian Sea exclusively) standards of marine environment quality.

Controlling function of environmental monitoring is focused only on marine areas subject to anthropogenic load. This function is focused on determining of the compliance between the expected and actual consequences of economic activities and revealing violations of adopted impact standards on the marine environment on the basis of the data of industrial (local) monitoring. It is indeed an important function, but its implementation greatly depends on the good will of the economic entity, as the legal background of this monitoring type is in embryo. Suffice it to say that normative acts consider it at the same time as engineering survey, activity in the field of hydrometeorology and related fields and industrial environmental control.

As far as the *instructive function* is concerned (we consider it the most important function of environmental monitoring) it is not implemented at all, as we have already said. The reason is poor integration of environmental monitoring in the system of environmental protection and a very slight link between environmental monitoring and environmental standard-setting. Underdeveloped standard setting is to blame, as well as the monitoring which is mainly focused on providing services to the federal authorities while it is the territorial level where it "faces" standard-setting.

On the whole we can say that environmental monitoring of the Caspian Sea implemented in the RF does not cope with its mission. In our opinion it is caused by the shortcomings of the legal and institutional framework of the monitoring, the drawbacks in the organization of environmental monitoring as a whole and environmental monitoring of marine water areas in particular.

The legal and institutional framework of the environmental monitoring of the Caspian Sea is:

- *unmanageable,* as formally nine out of thirteen subsystems of the Unified System of the State Environmental Monitoring are involved in its implementation, although two actually;

- *disoriented,* as it is aimed at providing services for the federal authorities in contrast to authorities of the constituent entities of the Federation responsible for sustainable development;

- *disunited*, as the interaction of different subsystems of the Unified System of the State Environmental Monitoring at federal level is underdeveloped and is absent at the regional level;

- *unbalanced*, as its main load falls to the account of the state environmental monitoring, and the monitoring performed by resource users has no legal background;

- *defective*, as poor mechanisms of integration of environmental monitoring in the system of environmental protection are destroyed; as a result it becomes pointless.

It is an extremely negative assessment, but it is done on purpose as no attention is paid to fine words. The assessment is extremely negative as it refers to environmental monitoring implemented in Russia, though in many other countries including the Caspian states things are even more complicated. There are no existing national systems of environmental monitoring which are completely perfect and wholly answer their purpose.

The amendments to nature conservation laws aimed at increasing the efficiency of environmental monitoring which came into force in January 2012 turned out to be incomplete. Actually both the Unified System of State Environmental Monitoring (USSEM) and the State Data Fund of the State Environmental Monitoring (SDFEM) make it possible to overcome the existing disunity among subsystems of the monitoring. However the USSEM has become even more unmanageable. The subsystems forming USSEM are composed of similar subsystems (it would be hard to describe this hierarchy). SDFEM in its turn is also far from being perfect. The Unified Information System on the State of Environment (USSE) having a successful analogy (the Unified System of Information on the Situation in the World Ocean) would be a better variant.

How should the legal and institutional framework for the environmental monitoring of the Caspian Sea be transformed for the monitoring to answer its purpose?

First of all, USSEM should be deprived of internal conflicts conditioned by numerous subsystems included in other subsystems. To achieve it, USSEM should be split into two blocks: the block of monitoring of natural environment components and the block of monitoring of special natural and natural-anthropogenic objects (such as marine water areas and Lake Baikal). The monitoring of each environmental component is implemented by a certain USSEM subsystem in accordance with its purpose, and the monitoring of special objects is implemented by several USSEM subsystems corresponding to basic components of these objects. The state information system of environmental monitoring should create special modules for

every special object, joining information flows coming from USSEM subsystems participating in its monitoring.

Secondly, to better integrate monitoring subsystems at federal level SDFEM should be replaced with USSE.

Thirdly, to better integrate monitoring subsystems at territorial level (at regional level as far as seas are concerned) within the framework of the state information system of environmental monitoring, however it is called, territorial and regional modules should be created to join information flows coming from USSEM subsystems participating in the monitoring of territories and regions. Authorities of the constituent entities of the federation should get a direct access to these modules.

Fourthly, the legal basis should be created for environmental monitoring implemented by resource users. To do it, the list of agencies obliged to carry out such monitoring should be determined first. The list of enterprises performing post-project analysis contained in the international convention "On Environmental Impact Assessment in Transboundary Context" can serve as an example. Introductions to the legal and regulatory framework of environmental monitoring should be made so that it would not be equal to engineering survey. Taking into account the fact that the main function of the monitoring implemented by resource users is the controlling function, this monitoring would be better considered as a type of industrial environmental control. Special attention in the legal framework should be paid to the interaction of resource users and state agencies in the field of environmental monitoring.

In the fifth place, to better integrate the environmental monitoring into environmental protection the help of scientists should be required as organizational measures only are not enough for it. In our opinion, there is sufficient scientific framework for it, and now it's time to transform it into normative - methodical, normative-technical and legal -regulatory documents. The creation of the unified system of environmental regulation, assessment and monitoring is the main objective of our further activities.

We can at last make the *national* system of environmental monitoring of marine areas perfect, but it is not enough for the mission to be completed for the Caspian Sea. The Caspian Sea ecosystem is unified, that is why environmental monitoring can produce a proper effect only when it's implemented jointly by all the Caspian states. The functions on implementing the monitoring should be distributed among the states or among the joint agencies created for this purpose. The first option will require more trust, and the second one - more money. In our opinion money should better be saved.

ANNEX 1

The Caspian Sea: global dimension

The Caspian and the Planet

The area of the Caspian Sea (water level being -27.0 m B.S.) makes 393 thousand km^2 or 0.08% of the planet's surface (510 m km^2), or 0.26% of the land's surface (149 m km^2), or 0.11% of the World Ocean area (361 m km^2), or 14.6% of the total area of the planet's lakes (2.69 m km^2).

The volume of the Caspian Sea water (water level being -27.0 m B.S.) makes 78.65 thousand km^3 or 0.005% of the planet's water volume (1.39 b km^3), or 0.006% of the World Ocean water volume (1.36 b km^3), or 43.8% of the total water volume of the planet's lakes (179.6 thousand km^3).

The volume of the river runoff to the Caspian Sea is estimated at 298.3 km^3 (1900-1982) or 0.7% of the total runoff of the planet's rivers (42.6 thousand km^3). The volume of atmospheric precipitations amounts to 73.7 km^3 (1900-1982) or 0.14% of the total precipitations amount on the planet (524 thousand km^3), or 0.62% of the total precipitations amount falling on land surface (119 thousand km^3).

Water evaporation from the Caspian Sea surface (1900-1982) makes 375.5 km^3 or 0.07% of water evaporation volume from the surface of the World Ocean (505 thousand km^3), or 0.5% of water evaporation volume from the land surface (72 thousand km^3), or 4.2% of evaporation volume from the planet's lakes surface (9.0 thousand km^3).

Discharge of salt to the Caspian Sea amounts to 81.1 m tons or 2.56% of salt discharge to the World Ocean (3,171 m tons). Discharge of suspended sediments to the Caspian Sea amounts to 45.43 m tons or 0.29% of the discharge of suspended sediments to the World Ocean (15.469 m tons) Discharge of organic matter to the Caspian Sea makes 2.5 m tons C or 1.18% of the discharge of organic matter to the World Ocean (212 m tons C).

The Caspian and the Man

About 80 m people, or 1.2% of the world population (which made 6.5 b people in 2005) reside in the Caspian Sea basin which areas makes 3.2 m square km (or 2.15% of the total land area). Population density in the Caspian Sea basin approximately amounts to 25 people/km^2, which is by 1.7 times less than in the world on average (44 people/km^2).

12.5 m people reside in the Caspian region, which includes the coastal areas (districts, regions, provinces) of Azerbaijan, Iran, Kazakhstan, Russia and

Turkmenistan, covering the area of 666.4 thousand km^2 (0.45% of the land area). Population density in the Caspian region amounts to 19 people/km^2 - by 2.3 times lower than in the world on average.

57.2 m people, or 0.9% of the planet's population, live in the Volga basin, which area makes 1.36 m km^2 (1/2 of the Caspian Sea basin or 0.9% of the land area). Population density in the Volga basin makes 42 people/km^2 - slightly lower than in the world on average.

The resources of the land surface water in the Caspian Sea basin amount to about 350 km^3, or 0.82% of renewable water resources of the planet (42.7 thousand km^3). Water supply of the basin population makes 4.4 thousand m^3 a year, which is lower than on the planet in general (7.6 thousand m^3/year). Total water consumption in the basin amounts to 75 km^3/year, or 2% of the total water consumption in the world. Irretrievable water consumption (taking into account water losses in evaporation in water reservoirs) makes 55 km^3/year, or 2.4% of the irretrievable water consumption in the world.

In 1900 300 thousand tons of fish (excluding Iran - further on) was produced in the Caspian basin, which made 7.5% of the world's production (4 m tons). In 1950 330 thousand tons of fish was caught in the Caspian basin, which made 1.7% of the world's production (20 m tons). In 2000, 220 thousand tons of fish was caught, which made 0.26% of the world's production (85 m tons), or 0.31% of fish catch in the World Ocean (70 m tons), or 1.47% of fish production in the inland water bodies of the planet (15 m tons). Currently fish catches make about 100 thousand tons - 1/5 of the possible catches in the Caspian basin, or 1/1000 of the possible world fish production (excluding aquaculture).

The Caspian Sea: Energy of life

The mass of the living matter (biomass) of the Caspian Sea amounts to 4/08 m tons C, or 0.0005% of the biosphere biomass (803.9 b tons C), or 0.14% of the living matter mass of the World Ocean (2,960 m tons C), or 0.0005% of the land biomass (800.9 b tons C).

Biomass of plants in the Caspian Sea (phytoplankton and phytobenthos) amounts to 0.51 m tons C, or 0.05% of biomass of plants of the World Ocean (960 m tons C), or 0.00006% of the biomass of the land plants (800 b tons C).

Biomass of the Caspian animals amounts to 3.57 m tons C, or 0.19% of the biomass of the World Ocean animals (2 b tons C), or 0.39% of biomass of land animals (924 m tons C).

The primary production of the Caspian Sea makes 143 m tons C/year, or 0.14% of the biosphere primary production (100 b tons/year), or 0.36% of the primary production of the World Ocean (40 b tons C/year), or 0.24% of the land primary production (60 b tons C/year).

The Caspian Sea is inhabited by 620 species of algae, or 3.1% from the number of algae species occurring in the World Ocean (20 thousand species), 1,050 species of animals or 0.6% of the number of animal species living in the World Ocean (180 thousand species) including 110 species of fish, or 0.6% of the number of fish species in the World Ocean (20 thousand species).

The Caspian Sea: Life of Energy

In 2007 115 m tons of oil will be produced in the Caspian region (Azerbaijan, Kazakhstan and Turkmenistan), which makes 2.8% of the world production (4.1 b tons/ year), at least 25% will be produced in the Caspian shelf. Proved oil reserves in the Caspian region amount to 5.1 b tons or 3.1% of the proved reserves in the world (162 b tons). By 2020 oil production in the region can rise to 150 m tons a year (Azerbaijan, Kazakhstan, Russia, Turkmenistan), at least 50% of production will be concentrated in the Caspian shelf.

In 2007 120 b cubic metres of gas will be produced in the Caspian region (Azerbaijan, Kazakhstan and Turkmenistan), which makes 4.4% of the world gas production (2.7 trillion cubic metres a year). Proved gas reserves in the Caspian region amount to 8.0 trillion tons or 4.4% of the proved reserves in the world (180 trillion cubic meters). By 2020 gas production in the region can rise to 180 b cubic metres a year, most part of gas (at least 90%) will be produced on land.

In 2006 118 b kilowatt-hour of electric energy was produced in the Caspian region (Azerbaijan, Kazakhstan, Turkmenistan, Russia), which made 0.9% of the annual electric energy production (12.93 trillion kilowatt-hour). 40-45 b kilowatt-hours of electric energy is produced in the Caspian basin rivers (the Volga, the Sulak, the Kura), or 0.3% of annual world production of electric energy (12.93 trillion kilowatt-hours). Hydroelectric stations of the Volga-Caspian reservoirs annually produce 35-40 b kilowatt-hours of electric energy, or 4% of electric energy production in Russia.

ANNEX 2

PROGRAMMES FOR CONTROLLING MARINE WATER QUALITY AT SSOC POINTS WITHOUT HYDROBIOLOGICAL PARAMETERS (in accordance with GOST 17.1.3.08-82 "Rules of marine water quality control")

I. Reduced programme
dissolved hydrocarbons, mg/dm^3 (mg/l)
dissolved oxygen mg/dm^3 (mg/l) and saturation %
pH value, pH units
visual observations of the state of a sea water body surface
II. Full programme:
chlorinated hydrocarbon including pesticides mcg/dm3 (mcg/l)
heavy metals (mercury, lead, cadmium, copper) mcg/dm3 (mcg/l)
phenols, mcg/dm3 (mcg/l)
Synthetic surfactants, mcg/dm3 (mcg/l)
additional ingredients specific for a certain area
nitrite nitrogen, mcg/dm^3 (mcg/l)
silicon, mcg/dm^3 (mcg/l)
water salinity %
water and air temperature °C
wind speed and direction, m/sec
water transparency, m
water colour, colour units
waves (visually), force

Note: In the course of visual observations unusual phenomena for this sea area are registered (the presence of floating matter, films, oil spots, impurities and other admixtures; growing, accumulation and die-off of algae; death of fish and other animals; mass beaching of molluscs (mussels), increased turbidity, emergence of unusual colour, foam etc.).

PROGRAMMES FOR CONTROLLING HYDROBIOLOGICAL PARAMETERS AT SSOC POINTS (in accordance with GOST 17.1.3.08-82 "Rules of marine water quality control")

I. Reduced programme
phytoplankton:

total number of cells, kl/dm^3 (kl/l)

species composition, the number and list of species

zooplankton:

total number of organisms, individuals/m^3

species composition, the number and list of species

microbial parameters:

total number of microorganisms, kl/cm^3 (kl/ml)

the number of saprophytic bacteria kl/cm^3 (kl/ml)

concentration of phytoplankton chlorophyll, mcg/dm^3 (mcg/l)

II. Full programme:

phytoplankton:

total biomass, g/m^3

species composition, the number and list of species

number of main systematic groups, number of groups

intensity of phytoplankton photosynthesis (primary production), mg C/m^3 ·day (mg C/l·day)

zooplankton:

total biomass mg/m^3

number of main groups and species, individuals/m^3

biomass of main groups and species, mg/m^3

microbial parameters:

total biomass, mg/dm^3 (mg/l)

quantitative distribution of indicator groups of marine microflora (saprophytic, oil-oxidizing, xylene-oxidizing, phenol-oxidizing, lipolytic bacteria, kl/cm^3 (kl/ml)

ANNEX 3

The list of general-purpose information services provided by Roshydromet organizations to information consumers irrespectively of their organizational-legal form in accordance with Resolution of the RF Government No. 1425 from 15/11/1997

I. Operating and prognostic information	
Information on natural disasters of hydrometeorological origin	Actual data on natural disasters of hydrometeorological origin
Information on extreme environmental pollution	Actual data on identified cases of extreme environmental pollution
1-3 day forecasts about hydrometeorological disasters	data on showers, strong winds, floods, typhoons, snowfalls, draught, dust storms, sea storms, severe frosts and heat
1-3 day forecasts for the areas of natural disasters, emergencies and catastrophes	the content of forecasts during search and rescue and restoration operations in emergency areas in each case are endorsed with agencies of Ministry for Emergency Situations of Russia
The forecasts on the distribution of pollutants, including radioactive ones and their concentration in the atmospheric air (water) on the basis of the data on emissions and discharges in emergency cases	the content of forecasts is determined by the received information on the emergency and its development
1-3 day weather forecasts for the areas of the constituent entities of the Russian Federation	air temperature at daytime and at night, weather phenomena (atmospheric precipitations, snowstorms, fogs, frosts, thunderstorms, hail, wind speed and direction, cloudiness)
5 day forecasts of pressure fields and geopotential in the Russian Federation	1-3 day numerical hydrodynamic forecasts of atmospheric circulation at the Earth's surface (Po) and at the level

	of 5 km (H500) (regional forecasts for the European and Asian regions)
The forecast of expected state of winter crops by the beginning of vegetation	areas with different state of winter crops by the beginning of vegetation in economic areas and in the Russian Federation in general
Forecasts of productive moist in the soil by the start of spring field work	areas with sufficient and insufficient stock of productive moist in a metre-thick layer of soil under the winter crops and autumn plough
Forecasts of crop capacity and croppage of basic agricultural plants	expected crop capacity and croppage of winter wheat and rye, spring wheat, spring barley, corn, buckwheat, all the cereal crops and leguminous plants, sunflower seeds, beetroot and potato tubers
Forecast of maximum level of the spring flood	level (cm) on the rivers: Volga, Kama, Don, Ob, Angara, Yenisey
Forecasts of rainfall floods	water level in the Amur river (cm) in July - September (compiled as the flood develops)
The forecast of water inflow to the reservoirs of the Volga-Kama, Angara-Yenisey and Tsimlyansk water reservoirs for a month and a quarter	volume of water inflow (in cubic metres)
one-day forecast of the state of magnetosphere and ionosphere of the Earth	solar activity and radiation situation on the routes of controlled space complexes, the state of the Earth's magnetic field, the state of ionosphere
Maps of average monthly distribution of fields of total ozone content	average monthly values of total ozone content in deviations from the climatic norm
Operative maps of distribution of abnormally low values of total ozone content	daily values of total ozone content in deviations from the climatic norm in the periods when low values of total ozone content are observed
Materials of observations of total	daily and average values of total

ozone content and ozone vertical distribution in the Antarctic throughout the period of spring anomaly	ozone content in deviations from the climatic norm in the Antarctic (stations Mirny and Molodezhnaya)
II. Analytical and reference information	
Materials to be included in the State Water Cadastre	data on water resources, their quality and water use in the constituent entities of the Russian Federation and large river systems (jointly with the MNR of Russia)
The overview of agrometeorological conditions for a ten-day period in the Russian Federation (with enclosed maps of precipitations quantity for a ten-day period and a month)	description of weather conditions, assessment of the impact of agrometeorological conditions on wintering, field works, growth, development and formation of basic agricultural crops
Meteorological yearbook	basic parameters averaged for months (air temperature, atmospheric pressure, wind, precipitations etc.).
Agrometeorological yearbook	summarized data of agrometeorological observations for a year
The overview of environmental pollution in the Russian Federation and materials to be included in the State Report "On the state of the environment in the Russian Federation"	summarized data on environmental pollution for the whole area of the Russian Federation
The overview of background state of the environment	summarized materials of background observations of the state of the environment
Yearbook of surface water quality in the Russian Federation	summarized data on surface water pollution for the whole area of the Russian Federation
Yearbook of state of surface water ecosystems in Russia (by hydrobiological parameters)	summarized data on main hydrobiological parameters of surface water quality for the area of the Russian Federation

Yearbook of marine water quality by hydrochemical parameters	summarized data on the pollution of the seas washing the territory of Russia
Yearbook of state of environmental objects pollution with pesticides in the Russian Federation	summarized data on environmental objects pollution with pesticides
Yearbook of urban atmospheric pollution in the Russian Federation	summarized data on urban atmospheric air pollution in the Russian Federation
Yearbook of soil pollution with toxic substances of industrial origin in the Russian Federation	summarized data on soil pollution with toxic substances of industrial origin around cities and industrial centres
Annual overview of environmental state of seas and separate areas of the World Ocean	results of ecosystem surveys of inland and surrounding seas, assessment of environmental situation of controlled sea areas
Yearbook "Radiation situation in Russia and adjacent states"	summarized data on radioactive environmental pollution in the Russian Federation and the CIS countries
Monthly information on emergency and extreme environmental pollution and radiation situation	data on the identified cases of high level of environmental pollution
Monthly information on elemental weather phenomena, hydrometeorological conditions and their impact on the activity of main economy branches	data on number, intensity and duration of elemental hydrometeorological phenomena and economic damage in the constituent entities of the Russian Federation
Quarterly bulletins on the state of the ozone layer	description of the state of the ozone layer
Annual overview of the state of the ozone layer	description of changes of the ozone layer

ANNEX 4

The list of hydrochemical parameters determined in the course of environmental surveys in the shelf in accordance with BCH-00-92 "Engineering survey in the continental shelf". Section 5. Engineering-environmental survey as part of engineering survey":

1. Salinity
2. pH value
3. Dissolved gases (oxygen, hydrogen sulfide, etc.)
4. Alkalinity
5. Content of sulphates
6. The content of magnesia mixture in terms of magnesium ions
7. Dissolved organic carbon
8. Biochemical oxygen demand for a 5-day period
9. Biogenic substances

a) phosphates;
b) total phosphor;
c) nitrates;
d) nitrites;
d) ammonium nitrogen;
e) total and organic nitrogen;
f) dissolved silicon;

10. Oil hydrocarbons (in water and bottom sediments)
11. Chlorinated hydrocarbons, including pesticides
12. Synthetic surfactants
13. Heavy metals

a) mercury Hg;
b) lead Pb;
c) cadmium Cd;
d) copper Cu;
e) arsenic As;
14. Phenol (carbolic acid)

All the ingredients are to be determined in three layers:
- surface;
-near-bottom layer;

- density transition zone.

Salinity is determined at all standard layers

ANNEX 5

Guidelines for the first stage of the joint programme of the monitoring of the Caspian Sea marine environment (Draft 2).

Introduction

In accordance with the Framework Convention for the Protection of the Marine Environment of the Caspian Sea, hereinafter named as the Convention, the Caspian littoral states "shall endeavour to establish and implement *individual* and/or *joint* programmes for monitoring environmental conditions of the Caspian Sea" (Article 19, item 1).

Since the time the Convention was signed, the Caspian states have made a sufficient progress in the elaboration of *individual* (national) monitoring programmes through using new observation methods and tools, developing information systems and improving the assessment of marine environment conditions.

At the same time the variety of marine environmental monitoring types has increased at the national level as well as the number of organizations taking part in it; and the differences between national environmental monitoring systems have become deeper at the regional level.

Taking the abovementioned into account, the implementation of the *joint* (regional) programme and the solution of other tasks related to marine environmental monitoring indicated in Article 19 of the Convention, should be started with the establishment and launch of cooperation mechanisms at national and regional levels, or, in other words, with the establishment of common background for individual programmes.

Cooperation mechanisms have been elaborated within the framework of different projects implemented throughout 1998 - 2011 under the guidance of CEP and CASPECO and supported by UNEP, UNDP, GEF and TACIS. In doing this, the Caspian littoral states have gained unrivalled cooperation experience in monitoring of the Caspian Sea marine environment .

1. General provisions

The main cooperation mechanism at the regional level is the distribution of functions on joint efforts to perform monitoring of the Caspian Sea environmental conditions (hereinafter referred to as *cooperative functions*), among all the Caspian littoral states and the established work groups, where they are equally represented.

At the first stage the cooperative functions will be implemented through international and individual assistance and through involving national resources of

the Caspian states; *further on* these functions will be mainly implemented by means of national resources (human, material and financial ones).

To harmonize various types of monitoring implemented at the national level it is advisable to establish National Coordinating Centres for the Caspian Sea monitoring in all the Caspian states using the facilities of organizations involved in its implementation and to delegate these Centres with authorities for implementing cooperative functions.

The activities of National Coordinating Centres at the regional level will be coordinated by Coordinating Bureau of the Joint Programme for monitoring of the Caspian Sea marine environment (hereinafter referred to as Coordinating Bureau), which functions will be performed at the first stage by the Secretariat of the Convention.

These Guidelines set a list of cooperative functions and their distribution among the executors as well as the main requirements to implementing these functions at the first stage of the Joint Programme for monitoring of the Caspian Sea marine environment.

Throughout the 1st stage detailed guidelines for implementing separate cooperative functions will be elaborated on the basis of the acquired experience; further on these guidelines will be joined in one single document.

Joint activities in the field of the Caspian Sea environmental monitoring at the first stage will be planned and implemented by the Coordinating Bureau taking into account the received international and individual assistance and the allotted national resources of the Caspian littoral states.

2. Cooperative functions in the field of monitoring of the Caspian Sea marine environment and their distribution among the Caspian littoral states.

Cooperative functions in the field of monitoring of the Caspian Sea marine environment	**Executors**	**Location**
Carrying out observations of marine environment conditions in the coastal area	*Authorized national organizations*	In each of the Caspian states
Ensuring uniformity of measurements and data quality control	*Work group I*	Islamic Republic of Iran
Receipt and analysis of satellite data on the condition of the Caspian Sea water	*Work group II*	Republic of Kazakhstan

area		
Collection, processing, storage and distribution of observation data	*Work group III*	Republic of Azerbaijan
Regular assessment of marine environment condition	*Work group IV*	Russian Federation
Interaction with executive agencies and the Convention protocols Public awareness raising	*Work group V*	Turkmenistan

To perform joint monitoring of the Caspian Sea marine environment five work groups are established, each in every of the Caspian states. Every state appoints one expert into every work group. Work group activity is supervised by the expert appointed by the state hosting the work group. The responsibilities of work group supervisors and experts are determined by the Coordinating Bureau. To support Work Group activities relevant staff from the host country are employed if necessary.

3. Main requirements to performing cooperative functions in the field of monitoring of the Caspian Sea marine environment.

3.1. Carrying out observations of the marine environmental conditions in the coastal water area

Each Caspian state selects at least 10 stations used for joint programmes of marine environment observations where observations will be carried out in accordance with these Guidelines. The stations selected by all the Caspian states make up a *joint observation network (JON).*

The JON stations are located at the depth of at least 5 metres in the North Caspian and at the depth of at least 10 metres in the Middle and in the South Caspian. The total number of stations is evenly distributed among the following *areas:* a) river estuaries; b) roadsteads of sea ports and big cities (with population of at least 50 thousand); c) areas of marine oil and gas blocks prospecting and development; d) recreational areas; e) areas with minimal anthropogenic load on the water area. In addition, the stations located in one area should differ from each other in hydrological and lithological conditions.

Observations at JON stations are carried out at least twice a year: in spring (April - May) and in autumn (October - November), simultaneously with the observations carried out in accordance with individual monitoring programmes. Observations are carried out during the summer season as well if possible.

Observations are made in the daylight under favourable hydrometeorological conditions.

The following measurements are made at every station: air temperature and humidity, wind speed and direction, wave height, period and direction, transparency and colour. Hydrological probes are used for measuring water temperature, electric conductivity and salinity in the surface and bottom layers. On-board observations include measurements of pH, concentrations of dissolved oxygen, mineral phosphor, nitrate and ammonium nitrogen, and dissolved silicon in water samples taken in the surface and bottom layers. The station coordinates, time and date of observations, sea depth and the results of meteorological, hydrological and hydrochemical observations are recorded in the special register.

Samples are taken at every station to determine: a) chlorophyll concentration, species composition, abundance and biomass of phytoplankton in the surface water layer; b) species composition, abundance and biomass of zooplankton in the water column from bottom to surface; c) species composition, abundance and biomass of zoobenthos.

Samples of suspended matter are taken at every station to carry out its chemical analysis and to measure its concentration in the surface and bottom water layers. In addition, samples of water (in the surface and bottom layers) and bottom sediments are taken to perform chemical analysis. Samples of bottom sediments are taken to determine their granulometric composition.

Samples of water and bottom sediments are analysed in coastal laboratories. A unified method is used to identify Fe, Mn, Zn, Ni, Cu, Pb, Cd and Hg in all the samples of water, suspended matter and bottom sediments. Concentrations of oil products[28], total nitrogen and phosphor are also measured in water samples; the content of organic carbon is measured in samples of suspended matter and bottom sediments. The content of main granulometric fractions, concentration of oil products, DDT and its metabolites and main HCCH isomers (α, β, γ) are determined in bottom sediments.

All observations, measurements, sampling and analyses in coastal labs are carried out in accordance with national practice, regulations and standards and the requirements to supporting unified measurement standards. The results of observations, measurements and analyses are submitted to the centralized database within a 3-month period.

3.2. Ensuring measurements uniformity and data quality control

[28] Oil products refer to substances extracted from samples of water and bottom sediments with help of non-polar solvents and going through activated aluminium oxide.

Performing the cooperative function to provide measurements uniformity and data quality control, *Work Group I*:

- maintains and supports the databases of a) organizations taking part in monitoring of the environmental conditions of the Caspian Sea at national level; b) stations of the joint observation network including the data on coordinates, depth, programme, date of observations launch, frequency and composition; c) methods and tools of observations and measurements used for monitoring of the environmental conditions of the Caspian Sea at national level;

- annually exercises interlaboratory calibration and external control of measurements quality (supplies the monitoring organizations with standard materials, analyses the received control results) and prepares annual report on methods, tools and quality of observations and measurements;

- creates and supports a special web site for access to databases and distribution of information on the joint observations network, and methods and quality of observations;

- elaborates "Guidelines for methods of monitoring environmental conditions of the Caspian Sea" in cooperation with other Caspian states using regional and international experience.

These guidelines are to provide for:

- the unification of methods and tools of observations carried out by the Caspian states within the joint observation network and within individual programmes;

- the increase of measured parameters of the marine environment, mainly by persistent organic pollutants;

- the use of biological methods (biotesting and bioindicators) to assess marine environment pollution.

All the Caspian states provide their assistance to WG-I in performing its cooperative function aimed at provision of measurements uniformity and data quality control.

3.3 Receipt and analysis of satellite data on the condition of the Caspian Sea water area

Performing cooperative function to receive and analyse satellite information on the condition of the Caspian Sea water area, *Work Group II*:

- provides for the receipt of satellite data on the sea level, temperature of the surface water layer, concentration of chlorophyll and suspended matter in the surface layer, number and area of oil spills in geographical regions and the whole sea water area;

- provides for the decoding of satellite data (using ship observations data if necessary), as well as processing and presenting these data with help of GIS technologies;

- establishes and maintains satellite data base and a special website for distributing satellite information on environmental conditions of the Caspian Sea among stakeholders and the community;

- elaborates "Guidelines for using satellite data for monitoring the Caspian Sea marine environment" in cooperation with other Caspian states using regional and international experience.

These Guidelines are to account for the increase in the number of the Caspian Sea parameters covered by satellite observations and introducing new techniques for using these data for the assessment of the environmental conditions of the Caspian Sea.

All the Caspian states provide their assistance to WG-II in performing its cooperative function on receipt and analysis of satellite data on the condition of the Caspian Sea water area

3.4 Collection, processing, storage and distribution of observation data

Performing the cooperative function for collection, processing, storage and distribution of observation data, *Work Group III*:

- receives from the Caspian states observations data of environmental conditions of the Caspian Sea at the stations of the joint observations network and converts them into a unified format complying with international standards;

-stores data on electronic media, regularly updates database description (metadata) taking into account new data and provides processing and presenting of these data with help of GIS technologies;

- receives the data of meteorological and hydrological observations from hydrometeorological organizations of the Caspian states through CASPCOM and compiles them into the database of monitoring of the Caspian Sea marine environment;

- creates and regularly updates the digital atlas of the Caspian Sea on the basis of the available database, designs and supports a special website to provide access to metadata, databases and the Caspian Sea atlas;

- elaborates "Guidelines for collection, transmission, processing, storage and distribution of observations data on environmental conditions of the Caspian Sea" in cooperation with other Caspian states using regional and international experience.

These guidelines are to provide for the unification of techniques used to collect, transmit, store and distribute the observations data on environmental conditions of the Caspian Sea and to integrate these techniques into a unified cycle.

All the Caspian states provide their assistance to WG-III in performing its cooperative function on collection, processing, storage and distribution of observation data on environmental conditions of the Caspian Sea.

3.5 Regular assessment of marine environment condition

Performing the cooperative function to perform regular assessment of the marine environment conditions, *Work Group IV*:

- analyses and classifies observations data on environmental conditions of the Caspian Sea at the stations of the joint observation network, satellite data as well as the information on the Caspian Sea pollution from on-land sources received from the relevant Convention protocol;

- creates and maintains a database of national standards and methods used in the Caspian states to assess the pollution of the marine environment of the Caspian Sea;

- performs integrated assessment of pollution of the Caspian Sea marine environment using methods and standards applied by the Caspian states as well as methods and standards used for this purpose in other countries and in international experience;

- designs and supports a special website for accessing databases and distributing information on the assessment of the Caspian Sea environment pollution;

- elaborates "Guidelines for assessment of the Caspian Sea marine environment" in cooperation with other Caspian states using regional and international experience. These guidelines are to provide for the unification of standards and methods used for performing this assessment.

In addition WG-V prepares the report on the state of the Caspian Sea marine environment. Alongside with the integrated assessment of the marine environment pollution, the following information is used:

- other types of anthropogenic load (apart from pollution) on the water area of the Caspian Sea received from the Caspian states;

- changes of climate and water balance of the Caspian Sea, provided by CASPCOM;

- state of the Caspian Sea biodiversity received from the relevant Convention protocol;

- state of water biological resources of the Caspian Sea received from the Caspian states through relevant joint commission;

The report on the environmental conditions of the Caspian Sea issued by the Coordinating Bureau after its endorsement by all the Caspian states, is to determine main factors of anthropogenic load on the marine ecosystem indicating their location in time - space domain. These factors are ranged by the level of impact on the marine environment. In addition, security level of the Caspian Sea marine environment should be assessed in relation to every factor and to anthropogenic load in general.

All the Caspian states provide their assistance to WG-IV in performing its cooperative function aimed at assessment of marine environment condition.

3.6 Interaction with executive agencies and the Convention protocols Public awareness raising

Performing the cooperative function to provide interaction with the executive agencies and the Convention protocols and public awareness raising, *Work Group V*:

- in cooperation with National Coordinating Centres prepares information and analytical materials on the environmental conditions of the Caspian Sea and the state of joint activities aimed at their monitoring for executive agencies and the Convention protocols;

- maintains and supports the databases of a) higher educational institutions of the Caspian states, preparing specialists in the field of marine environmental monitoring; b) scientific and research organizations carrying out research of the Caspian Sea; c) national and international experts in the field of the Caspian Sea environmental monitoring; d) public organizations of the Caspian states and international public organizations which participate in the protection of the Caspian Sea marine environment and the electronic library of scientific, popular science and journalistic publications in this field;

- creates and supports the website of the joint programme of the Caspian Sea marine environmental monitoring and displays the created databases and the guide on information resources in the field of the Caspian Sea environmental monitoring and prepares communications for the mass media covering the related events;

- elaborates "Guidelines for interaction with executive agencies and the Convention protocols on monitoring of the Caspian Sea marine environment and raising public awareness on its condition" in cooperation with other Caspian states using regional and international experience.

All the Caspian states provide their assistance to WG-V in performing its cooperative function aimed at provision of interaction with executive agencies and the Convention protocols and public awareness raising.

4. Final provisions

The first stage of the Joint Monitoring Programme of the Caspian Sea environmental monitoring starts with the adoption of these Guidelines at the conference of the Convention parties.

The first stage of the Joint Monitoring Programme of the Caspian Sea environmental monitoring completes with the adoption of the complete Guidelines for marine environmental monitoring at the conference of the Convention parties, which means the full-scale implementation of these guidelines.

The complete guidelines are made up by the Coordinating Bureau on the basis of separate guidelines for performing cooperative functions in the field of Caspian Sea environmental monitoring elaborated by the Caspian states.