

**Framework Convention  
for the Protection of the Marine  
Environment of the Caspian Sea**

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**CONFERENCE OF THE PARTIES  
Fourth Meeting  
Moscow, 10-12 December 2012**

Items 8 and 12 of the provisional agenda

**UNIFIED, INTEGRATED AND AFFORDABLE CASPIAN ENVIRONMENT MONITORING  
PROGRAMME AMONG THE CONTRACTING PARTIES TO THE FRAMEWORK  
CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE  
CASPIAN SEA**

Note by the interim Secretariat

1. Article 19 of the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (“Tehran Convention”) stipulates that the Contracting Parties shall:

- endeavour to establish and implement individual and/or joint programmes for monitoring environmental conditions of the Caspian Sea;
- agree upon a list and parameter 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;
- harmonize rules for the setting up and operation of monitoring programmes, measurement systems, analytical techniques, data processing and evaluation procedures for data quality; and
- develop a centralized 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(...).

2. The Strategic Convention Action Programme, adopted as a comprehensive ten year agenda and framework for the implementation of the Convention and its future Protocols at COP2, reaffirms the Caspian littoral States’ commitment “to ensure regional cooperation in the elaboration and implementation of harmonized regional monitoring programmes of pollutants, of rules and standards, and recommended practices and procedures consistent with the Tehran Convention”.

3. To that end, both the Programme of Work adopted at COP2 and the GEF/UNDP CaspEco project, launched in April 2009, provided for the development of a (Unified, Integrated and Affordable Caspian) Environment Monitoring Programme (EMP).

4. At a meeting on 9-10 September 2009, in Ashgabat, Turkmenistan, delegations of the Contracting Parties were briefed and exchanged views on the elements of a shared environmental information program for the Caspian Sea region, including a monitoring program, reporting modalities and a web-based information centre. Presentations were made by representatives of the Black Sea Commission, the Helsinki Commission, the European Environment Agency and the EU TACIS project on Caspian Water Quality Monitoring. Following the meeting, the Governments were, by letter of 29 September 2009, requested to nominate an expert for the preparation of the first State of the Caspian Sea Environment Report.

5. In 2010, a Working Group on Environmental Monitoring composed of national experts from the five Caspian littoral countries was established under the GEF/UNDP Caspeco Project and the first technical Working Group Meeting was held in Ashgabat, Turkmenistan, on 10-11 November 2010.

Nominated members of the Working Group on EMP included: Mr. Niyazi Ismailov (Azerbaijan), Mr. Mohammad Reza Sheikholeslami (I.R. Iran), Ms. Zauresh Abdiyeva (Kazakhstan), Ms. Olga Melnik (Kazakhstan), Mr. Alexander Korshenko (Russian Federation), Mr. Sergey Monakhov (Russian Federation) and Ms. Tatiana Tzura (Turkmenistan).

6. At their second Meeting in Ashgabat, 15-17 March 2011, the Working Group on EMP decided to establish a core team under the lead of a regional consultant, which would:

- identify and draft the parameters for monitoring the quality of the waters of the Caspian Sea, required for the implementation of the Tehran Convention and its Protocols and taking into account the need for a broad ecosystem approach;
- identify and propose the network of institutional capacity available and required (gap analysis) for monitoring, taking into account the necessary sampling frequency and monitoring methodology harmonization needs; and
- and map out and make recommendations as to the road towards creating a system of harmonized data collection and analysis.

The Working Group on EMP further reviewed the First State of the Environment (SOE) report prepared by UNEP/Grid-Arendal on the basis of the replies received on a questionnaire and already available publications, and acknowledged that a full and comprehensive SOE report can only be prepared once the proposed EMP is operational and the legal framework, in particular the protocols, with specific commitments related to monitoring, is in force. Further guidance would be needed as to the extent in which SOE reports should only contain facts or include analysis, trends and projections. Following the meeting, the draft of the SOE report underwent several rounds of comments and was finalized and presented to COP3.

Following the meeting in Ashgabat, the members of the Working Group on Environmental Monitoring (Lead Regional Consultant, Core Group Members and National Experts) were tasked to finalize the preparation of a system of harmonized data collection and analysis, including the proposed designation of lead institutions, capacity building needs and budget requirements based on the existing national environmental monitoring programs, results of the TACIS Caspian Monitoring Action Plan, and results of the work done in CEP-I and CEP-II on pollution monitoring.

7. The Core Working Group was established in May/June 2011 and the first draft of the EMP was prepared and distributed in English to the countries for comments and recommendations on 9 July 2011.

8. At COP3, in Aktau, 12 August 2011, the Ministers and High-level Officials of the Contracting Parties requested the interim Secretariat “to assist and coordinate the activity aimed at the development of proposals on monitoring of the state of the environment of the Caspian Sea”.

They furthermore “welcomed the presentation of the first State of the Environment report as a comprehensive document to implement the activities of the Caspian Environment Program and the Tehran Convention”, decided that “the next SOE report should be issued in four years time” and requested the (interim) Secretariat “to develop for submission and decision by COP4 a format for future SOE reports with major indicators and networks of institutions capable of measuring the quality of the waters of the Caspian Sea”.

9. To that end, the Program of Work of the Tehran Convention for 2011-2012, adopted at COP3, provided for further support to the development of a programme on monitoring of the state of the environment and measures in selected priority areas for the Tehran Convention, including the identification of available capacity, needs and requirements for monitoring as well as the definition of priority areas and development of indicators for environmental monitoring in the Caspian Sea.

10. At the final EMP Working Group Meeting, held on 25 November 2011 in Ashgabat, the lead consultant of the core group presented and the meeting reviewed the second draft of the Unified, Integrated and Affordable Caspian Environmental Monitoring Program (distributed to the WG members and National Focal Points on 24 October 2011). Delegations welcomed and agreed with the proposed program and it was decided that, based on the exchanges and the report of the consultant, in particular its section 4 (sampling media, parameters and priorities; practicalities), a concrete EMP proposal would be prepared for submission to and adoption by COP4.

The meeting further agreed that the proposed EMP should as a minimum, and for the time being maximum, enable measuring the quality and trends of the marine environment of the Caspian Sea for the purpose of collective policy and decision-making related to the implementation of the Convention and its Protocols, taking into account and building upon the available national monitoring structures and institutions and introducing, where relevant (complementary) remote sensing options. The proposal, which should also in general identify training and capacity building needs, should be short and understandable for the decision-makers at COP4.

Comments on the EMP proposal would also be solicited from the Coordinating Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea (CASPCOM) Secretariat as well as from the Ocean Experimental Physics Laboratory of the Russian Academy of Sciences for remote sensing.

11. The EMP proposal (distributed on 6 February 2012) was presented at the Final Steering Committee Meeting of the GEF/UNDP Caspeco Project in Moscow, 16 March 2012. Final comments were received by mid April 2012 and incorporated in the final version of the EMP proposal, as contained in Annex I to this Note.

### **Suggested action**

12. The Conference of the Parties may wish to:

- a) Adopt the EMP contained in document TC/COP4/7 as a framework for capacity building and regional cooperation for monitoring the parameters which determine the quality of the marine environment of the Caspian Sea, as well as for capacity-building;
- b) Request the interim Secretariat to coordinate and promote its implementation with the involvement and/or support of CaspCom, the GEF, the EU, and other stakeholders, including the oil and gas industry.

Unified, Integrated, and Affordable Caspian Environment Monitoring Program (EMP) among Contracting Parties to the Tehran Convention

EMP (Summary)

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## Introduction

The Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran Convention\*) recognized the importance of monitoring environmental condition of the Caspian Sea, as stated in Article 19;

1. The Contracting Parties shall endeavour to establish and implement individual and/or joint programmes for monitoring environmental conditions of the Caspian Sea.

2. The Contracting Parties shall agree upon a list and parameters of pollutants which discharge into and concentration in the Caspian Sea shall be regularly monitored.

3. The Contracting Parties shall, 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.

4. For these purposes, the Contracting Parties shall endeavour to harmonise rules for the setting up and operation of monitoring programmes, measurement systems, analytical techniques, and data processing and evaluation procedures for data quality.

5. The Contracting Parties shall 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.

In order to fulfil the commitment of the Contracting Parties to the Tehran Convention\*, the present draft *Caspian Sea Monitoring Program (EMP)* is prepared. The EMP outputs will serve as vital inputs to Caspian Information System. This system is not intended to be simply a repository of historical information. It is primarily intended as an environmental management tool, which will enable users to:

- a) Add to the existing data set on a regular basis;
- b) Access the cumulative data set, and evaluate changes and trends in environmental quality;
- c) Draw conclusions about the environmental health of the Caspian ecosystems, and make informed environmental management decisions;
- d) Prioritize environmental resources for protective and remedial actions;
- e) Present objective justification for environmental funding decisions and requests.

\* (as signed on November 4, 2003 by the Azerbaijan Republic, the Islamic Republic of Iran, the Republic of Kazakhstan, the Russian Federation; and Turkmenistan and entered in to force on 12 August 2006

## 1- Objectives

The objectives of the Environment Monitoring Program (EMP) among the Contracting Parties to the Tehran Convention is to develop a framework providing the necessary data and information on the Caspian environment in order to; initially provide data on the state of the Caspian environment, highlight pollution problems, provide biological related data which will support the broad objective of tracking changes of the health and diversity of ecosystems in, and adjacent to, the Caspian Sea. The EMP information can be used to

evaluate the effectiveness of policies, and eventually determine long-term trends and action to be made at national and regional level for remediation and mitigation including:

- Full contribution of five Caspian Littoral States for development and implementation of the EMP, which is in line with monitoring environmental conditions of the Caspian Sea, Article 19 of Tehran Convention;
- Providing needed data and information for the preparation of State of the Environment (SOE) of the Caspian Sea". With the aim to ensure "regular, accurate, up to date and accessible information about environmental conditions of the Caspian Sea;
- As management tool for Prevention, Reduction and Control of Pollution in Caspian Sea, as the objective of the Tehran Convention;
- Providing monitoring data and information to the existing web-based Caspian Information Centre (CIC) and in line with Exchange of and Access to Information, Article 21 of the Tehran Convention.

## 2- Rationale

- Realizing that the most important steps in establishing or upgrading an EMP are to agree on the objectives and design of the system to address those objectives mentioned in above;
- Recognizing that the establishment of EMP, collecting data, maintaining a database, and carrying out appropriate analysis are time consuming and costly in terms of both human and financial resources ;
- It is therefore important to focus resources and priorities on those areas where the information is most needed and most useful;
- Knowing that the experiences and recommendations in "Regional Seas Programme" at global level , as well as the results of workshops and pilot monitoring program conducted both by GEF/UNDP and EUTACIS in the Caspian region, have indicated that the "regional" programme should start small and aim to grow;
- Understanding that any proposed EMP system would have to be that it is feasible from technical, practical and financial standpoint, and the scale of such systems needs to be kept to a realistic minimum, and the greatest possible use must be made of the data collected;
- Knowing that the linkages between contaminant, biological and other ambient environmental monitoring are inevitable and needs to be integrated together in development of an EMP in the Caspian Sea;
- Referring to the experience in other Regional Seas Programmes, also reveals that an EMP started with limited number of key pollutants, complementary physical, chemical and biological parameters and improved gradually by the time. Key features include setting clear objectives and quality assurance / quality control procedures, and finally, the programme must be sustainable;
- Understanding that the countries have a proprietary interest and should develop their own monitoring programme, thus, the regional programme has to be seen as a part of the national programme;
- In order to fulfill the national interest, regional immediate needs as well as the future demand of Caspian region for comprehensive assessment of environment in Caspian Sea, a sustainable regional programme must be flexible and evolving.

On the basis of above mentioned principles, the approach for development of EMP should have sufficient capacity for future expansion. Then programme would have to be modular in construction, which would facilitate future growth to consider new and emerging pollution or



environmental issues. Therefore the successful and sustainable EMP should be based on flexible and evolving principles as outlined below:

- Flexible (Modular approach)
- Based to much possible extend on existing national monitoring programmes and regional environmental related activities such as The Coordination Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea (CASPCOM),
- Continue to some extend the long-term measurements of traditional water quality monitoring investigations, including eutrophication,
  - Add to the list of controlled parameters analyses of sediments and biota for a restricted list of contaminants (key contaminants),
  - Fostering research project and pilot studies for future expansion of sampling media and parameters.
- Evolving
  - Phase 1: More focusing on existing national monitoring and capacity building, quality management schemes, developing regional database and having some research projects for future expansion.
  - Phase 2: The Survey, especially to identify pollution hot spots; expansion to consider other pollutants, biological parameters and new area of environmental monitoring and techniques
  - Phase 3: evaluate effectiveness of possible remediation and mitigation policies; and trend monitoring.

### 3- Proposed Regional Environmental Monitoring Programme (EMP)

The proposed EMP for the Caspian Sea are based particularly on the following documents including:

- On going national environmental monitoring activities
- Experience and lesson learned in development and implementation of regional marine Environment monitoring programme in other regions of the world (Regional Seas Programme) ;
- Published scientific reports/papers concerning the various aspects of caspian sea environment ;
- Particularly the efforts being done regionally in Caspian Sea to figure out the environmental and, emerging issues , priorities, and existing capacity of the member states for implementation of EMP such as:
  - ✓ Assessment of existing monitoring states conducted by CEP and EU/Tacis during past 10 years (2000-2010) to figure out the national capacity in each of member states of Tehran Convention ;
  - ✓ Caspian Sea Basin Wide Coastal Sediment Contaminant Screening Programme results and findings, conducted by CEP-1 during 2000 -2001 in order to create an up to date high quality contaminants data, figure out the Priority pollutants and to fill the gaps and serve as reliable and supplementary inputs to TDA, SAP, and NAPs reports preparation ;

- ✓ ECO-TOX project results and findings concerning Investigation into Toxic Contaminant Accumulation and Related Pathology in the Caspian Sturgeon, Seal and Bony Fish in the Caspian sea conducted by World Bank during 1999-2002;
- ✓ Results, findings and Lesson learned in implementation of Regional Pilot Pollution Monitoring Programme (RPMP) among Caspian Sea littoral states conducted by CEP-II during 2005 concerning sediment quality and assesses marine pollution in the coastal zone and assessment of national analytical laboratories capacity and performance ;
- ✓ Results of monitoring study of *Beroe ovata* and *Mnemiopsis leidyi* in the Southern Caspian during 2004- 2005;
- ✓ Rapid assessment of point and non-point sources of caspian coastal areas conducted by CEP-I and CEP-II during 2000 to 2008;
- ✓ Assessment of point sources pollution of the caspian coastal areas conducted by EU/Tacis during 1999 to 2004 ;
- ✓ Recommendation of 4th Meeting of the CEP-II Pollution Regional Advisory Group (P-RAG). Baku 11-13 October 2005, concerning recommended sampling media, contaminant parameters, complementary parameters, number of stations and sampling frequency for development of a regional monitoring programme in Caspian Sea;
- ✓ Results and findings of CEP-II Caspian major rivers contaminant study concerning the priority pollutants inflowing to the Caspian Sea during 2005 -2007 ;
- ✓ Results and Findings of CEP-II Monitoring study on *Beroe ovata* (BO) and *Mnemiopsis leidyi* (MI) during 2005 concerning the fluctuation of population and dynamics of MI in the Southern part of the Caspian Sea;
- ✓ Findings and recommendations resulted from CEP-II Anomalous Algal Bloom – AAB studies using remote sensing technique during 2005 -2006 ;
- ✓ Findings and recommendations of CEP-II Biodiversity Monitoring Programme "BMP" for identification of areas of special importance and/or sensitivity within an ecosystem approach and framework during 2006-2007 ;
- ✓ Findings and recommendations of TACIS Caspian MAP project "The Caspian Water Quality Monitoring and Action Plan for Areas of Pollution Concern" and proposed for Regional Water Quality Monitoring Plan in Caspian Sea during 2005-2009;
- ✓ The results and minutes of Ashgabat Meeting for development of EMP (CaspEco 16-17 March 2011) to define objective and function of EMP in Tehran Convention ;
- ✓ The draft EMP presented in Ashgabat Meeting for development of EMP (CaspEco 23-25 November 2011) ;
- ✓ Inputs from nominated national expert from each member states of Tehran Convention as EMP working group for development of EMP;
- ✓ Results and findings of Radiological survey of the Araks and Kura rivers conducted by IAEA in 2005;
- ✓ CEP Data and information Management System (used to assess existing data availability and exchange among littoral states) ;

- ✓ The survey conducted by CaspEco Project on activities of Coordinating Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea "CASPCOM" ( used as a possible source of national environmental monitoring data in EMP ).

### 3-1- Time Table of Caspian Sea EMP Development Plan

On the basis of the principle presented in section 2, and the results of major documents presented in above, a 3 Phase programme is proposed for the Caspian Sea EMP long-term operation. Table 3-1 presents the major monitoring characteristics in each phases. On the basis of the improvement achieved by the region by the time in future, the proposed duration for each phases can be reduced/optimized accordingly.

*Table 3-1: Major monitoring characteristics in each proposed EMP phases*

Major monitoring characteristics	Approximate Duration	Caspian EMP Phases
The primary focus in this period is proper linkages with on going national environmental related monitoring activities, measurements of key regional parameters and ensure that national laboratories/research institute can produce good data. This will entail capacity building, training programmes, and establishing quality management schemes (QA/QC). Results will contribute to a regional database. A secondary objective would be to foster pilot and research projects.	3-5 years	Phase 1
The ongoing contaminant and biological survey will continue. Key results will allow the identification of pollution hot spots and other environmental issues, which in turn should prompt national and regional actions for remediation and mitigation. Phase 2 can be expanded to include additional physical, chemical and biological parameters or matrices. Additional pilot projects, habitat monitoring study and research projects would be undertaken.	10 years	Phase 2
Contaminant / environmental monitoring during this period will change in emphasis from a survey mode to trend monitoring. This permits the evaluation of the effectiveness of remediation and mitigation policies. Research would also continue.	Continued for long term operation	Phase 3

### 3-2- Sampling Media, Parameters and Frequencies in Phase-I of Proposed Caspian EMP

#### 3-2-1- The Bases for Selection of Media and Parameters

The selection and definition of media, parameters and priorities in phase 1 can be classified on the basis of different environmental resources use and management objectives such as protection of biodiversity, fisheries, protected areas of national interest, port and harbors, recreational waters, general ecosystem protection, dumping of dredged spoils, climate change & sea level fluctuation and etc... In case of caspian Sea, it is focused mainly on the:

- 1) Acute transboundary problems of the Caspian Sea,
- 2) On going national Caspian environmental monitoring and
- 3) The capacity of the region for implementation of the EMP.

#### 3-2-2- Monitoring Media, Parameters and Frequency for Phase 1 of EMP

The parameters to be measured in Phase 1 are divided in 3 categories;

- 1) The most key transboundary parameters (green boxes) which are “Obligatory or OB types of parameters”, are comprising of two components; the Pollution and the Biological monitoring: In this category, The proposed pollution monitoring media for OB types parameters will be limited only to the “Bottom Sediment” of the Caspian Sea. These parameters must be measured by each member states within the framework of agreed EMP in Phase1. The proposed biological monitoring in this category will be the study of Population and dynamics of *Mnemiopsis leidyi*(ML) in water column. In addition, there are other complementary environmental parameters (in air, sediment, water and biota) which may not be categorized as transboundary but since they well contribute to the environmental assessment, some of them also considered as OB parameters. Table 3-2 presents the media, parameters, frequency and general type of measurements in this category.
- 2) Key transboundary parameters that should be measured by Remote Sensing (RS) under specific programme (case study) named “Specific Obligatory Survey-SOS” (Blue Boxes). This part of monitoring will be a basin wide Remote Sensing observation and should be implemented by one of the competent institute/organization within the Caspian Region. The competent agency can be selected/agreed collectively by the member states at a later stage. Table 3-2 also presents the media, parameters, frequency and general type of measurements in this Category.
- 3) The possible national parameters or “Optional or OP types of Parameters”. These parameters considered in phase 1 on the basis of on going National Monitoring Programme (NMP) framework and may differ and be ununified among the countries.

### 3-2-3- Integration of EMP into National Monitoring Programme

At present each Contracting Parties to the Tehran Convention is enjoying its own on going National Monitoring Programmes (NMPs) . The Contracting Parties should consider to include the proposed obligatory elements of EMP phase 1 in their NMPs as described in section 3-2-2. The NMPs may cover a wide range of parameters and techniques beyond the proposed obligatory parameters in the EMP such as;

- More contaminant parameters in sediment, water column and biota of the Caspian Sea (for example DDE, DDD, Lindane Isomers, PAHs, PCBs, radionuclides and etc), as well as contaminant influx from the rivers,
- Hydro-meteorological /Climatic Parameters in air and water column
- Climate related parameters (rivers inflow , Sea Level measurements/observations)
- Hydrochemistry/physico chemical, biological parameters and etc),
- Health related parameters (microbial parameters),
- Fisheries related research , monitoring and fish catch data,
- Habitat Monitoring with different dimensions

Therefore the on going or planned national monitoring parameters beyond the proposed EMP will remain unchanged, and can be considered as “Optional Parameters or OP” to the EMP. These data and information may be shared with region if the Contracting Parties agreed to exchange OP types of data and information.

Tables 3-2 summarize the potential types of monitoring, media and parameters may exist in proposed EMP indicating “OB “(green box), “SOS” (blue box) and “OP” (yellow box). There is no limitation for Contracting Parties to expand or limit their NMPs , but each country should fulfil at least the OB parameters in their national monitoring programme. In this connection, tables 3-3 to 3-6 provide more detail of EMP parameters integrated with potential NMP including; pollution monitoring in sediment, Pollution/Hydrochemistry and Nutrient Monitoring in Water Column, Pollution Monitoring in Biota , Biological Monitoring, and Hydrometeorological Parameters /Climate and Hydrology related Monitoring.

Table 3-2: Summary Of proposed Caspian Sea EMP Phase1 (Potential Monitoring)

General Types of Measurements /Observations	Type of Parameters	Frequency	Sampling Media	Parameters
				• <b>Pollution</b>
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Total Petroleum Hydrocarbons- TPH (Standard Oil Equivalent)
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water	
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Sediment/water/biota	PAHs and PAH metabolites
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	DDT
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/ Biota	
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/biota	DDT metabolite {DDE & DDD}
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Lindane - gamma-hexachlorocyclohexane, ( $\gamma$ -HCH)
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Biota	
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Lindane Isomers – (alpha-HCH and beta-HCH
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	PCBs
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Other Chlorinated Hydrocarbons
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Marine Antifoulants
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Personal Care Products (PCPs)
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Pharmaceuticals
Case Study	OP	Under the NMP	Biota	Biomarker and mussel watch
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Extracted Organic Matter (EOM) – Complementary

Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Lipid content - Complementary
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Cu, Hg, Zn, Al , Fe
Direct sampling and analytical laboratory measurements	OP		Water/Biota	
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Radio nuclides
Direct sampling and analytical laboratory measurements	OP	Under the NMP	Water/Sediment/Biota	Other Metals
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Total Organic Carbon (TOC) - Complementary
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Grain Size - Complementary
Direct sampling and analytical laboratory measurements	OB	1-2 year	Sediment	Carbonate - CO <sub>3</sub> - Complementary
				• <b>Biological Monitoring</b>
Case study/ Direct sampling and population counting of MI	OB	Seasonal or less	Water	Population and dynamics of Mnemiopsis leidyi (MI)
Case Study/Under the NMP	OP	Under the NMP	Biota	Fish Survey/Catch
			Water	• <b>Anomalous Algal Bloom (AAB) /SST Monitoring</b>
Case Study/Basin wide - Remote Sensing Technique	SOS	Monthly or less	Water	Chlorophyll
Case study/Basin wide - Remote Sensing Technique	SOS	Monthly or less	Water	SST
Direct sampling and analytical laboratory measurements/ in-situ measurements	Partly OB/OP	Monthly or less	Water	Hydro-Chemistry and Nutrient - Complementary
Case Study	OP	Under the NMP	Air/water/sediment/Biota	• <b>Habitat Monitoring</b>
Under NMP/COSPCOM protocol/ provisions	OP	Under NMP/COSPCOM protocol/ provisions	Air/water	• <b>Hydrology and related Climate Monitoring</b>
				• <b>Water Level Measurements</b>
Stationary recording system	OP	Under the NMP	Water	Stationary measurements
Basin Wide Observation – Remote Sensing/Case study	OP	Under the NMP	Water	Radar Altimetry technique

Table 3-3: Proposed Caspian EMP phase1 along with potential elements of national monitoring programme (Pollution Monitoring in Sediment)

Frequency	No of Stations	Type of Parameters		Parameters in Sediment Sample
		OB	OP	
1-2 year	Minimum 5-8 or more	*		Total Petroleum Hydrocarbons (Standard Oil Equivalent)
NMP	NMP (4)		*	Polyaromatic Hydrocarbons (PAHs)
1-2 year	Minimum 5-8 or more	*		DDT
NMP	NMP		*	DDT metabolites (DDE & DDD)
1-2 year	Minimum 5-8 or more	*		Lindane - gamma-hexachlorocyclohexane, ( $\gamma$ -HCH)
NMP	NMP		*	Lindane Isomers – (alpha-HCH and beta-HCH)
NMP	NMP		*	Other Chlorinated Pesticides
NMP	NMP		*	PCBs
NMP	NMP		*	Marine Antifoulants
1-2 year	Minimum 5-8 or more	*		Extracted Organic Matter (EOM)- Complementary
1-2 year	Minimum 5-8 or more	*		Lipid content- Complementary
1-2 year	Minimum 5-8 or more	*		Cu, Hg, Zn, Al , Fe
NMP	NMP		*	As , Cd ,Cr ,Mn, Co, Pb / others
NMP	NMP		*	Radio nuclides
1-2 year	Minimum 5-8 or more	*		Total Organic Carbon (TOC)- Complementary
1-2 year	Minimum 5-8 or more	*		Grain Size- Complementary
1-2 year	Minimum 5-8 or more	*		Carbonate - CO <sub>3</sub> - Complementary
NMP	NMP		*	Other parameters /National Interest



Table 3-4: Proposed Caspian EMP phase1 along with potential elements of national monitoring programme (Pollution/Hydrochemistry and Nutrient Monitoring in Water Column)

Frequency	No of Stations	Type of Parameters			Parameters/Study for Water
		SOS	OB	OP	
Monthly or less	Minimum 5-8 or more/NMP		*		pH- Complementary
Monthly or less	Minimum 5-8 or more/NMP		*		Salinity- Complementary
Monthly or less	Minimum 5-8 or more/NMP		*		Temprature- Complementary
Monthly or less	Entire basin by remote sensing	*			Basin wide SST distribution (Remote Sensing)
Monthly or less	Entire basin by remote sensing	*			Basine wide Chlorophyll distribution (Remote Sensing)/ Anomalous Algal Bloom
Monthly or less	Minimum 5-8 or more/NMP			*	Chlorophyll- Complementary
Monthly or less	Minimum 5-8 or more/NMP		*		Nutrients (P total, PO4, NO3, No2 and NH4)- Complementary
Monthly or less	Minimum 5-8 or more/NMP		*		DO- Complementary
NMP	NMP			*	H2S, BOD/COD/ Turbidity , color, Transparency ,TSS
NMP	NMP			*	TOC
NMP	NMP			*	Phenol (volatile)
NMP	NMP			*	Phenol (Chlorinated)
NMP	NMP			*	detergents
NMP	NMP			*	Microbial quality
NMP	NMP			*	Agrochemicals (chlorinated pesticides) DDT, DDE, DDD, Lindane, alpha-HCH and

					beta-HCH and the others
NMP	NMP			*	Industrial chemicals, including (PCBs)
NMP	NMP			*	Total Petroleum Hydrocarbons (Standard Oil Equivalent)
NMP	NMP			*	Polyaromatic Hydrocarbons (PAHs)
NMP	NMP			*	Marine Antifoulants
NMP	NMP			*	Metals
NMP	NMP			*	Radio nuclides
NMP	NMP			*	Other parameters / National Interest

Table 3-5: Proposed Caspian EMP phase1 along with potential elements of national monitoring programme (Pollution Monitoring in Biota & Biological Monitoring)

Frequency	No of Stations	Type of Parameters		Parameters
		OB	OP	
				<b>Pollution Monitoring</b>
NMP	NMP		*	DDT
NMP	NMP		*	DDT metabolites (DDE & DDD)
NMP	NMP		*	Lindane - gamma-hexachlorocyclohexane, ( $\gamma$ -HCH)
NMP	NMP		*	Lindane Isomers – (alpha-HCH and beta-HCH)
NMP	NMP		*	Other Chlorinated Pesticides
NMP	NMP		*	PCBs
NMP	NMP		*	PAH metabolites
NMP	NMP		*	Organometallic compounds
NMP	NMP		*	Metals
NMP	NMP		*	Radio nuclides
NMP	NMP		*	Biomarkers

NMP	NMP		*	Mussel watch
NMP	NMP		*	Other parameters (within National Interest)
				<b>Biological Monitoring</b>
Seasonal or less	where appropriate	*		Population and dynamics of Mnemiopsis leidyi(MI)
NMP	NMP		*	Plankton studies/monitoring
NMP	NMP		*	Benthic studies/monitoring
NMP	NMP		*	Fish studies/monitoring
NMP	NMP		*	Specific Aquatic/Terrestrial Habitat Monitoring (Case Studies)
NMP	NMP		*	Other biological related studies and monitoring

Table 3-6: Proposed Caspian EMP phase1 along with potential elements of national monitoring programme (Hydrometeorological Parameters /Climate and Hydrology Monitoring)

Frequency	No of Stations	Type of Parameters		Parameters
		OB	OP	
Under COSPCOM protocol/provisions	Under NMP & COSPCOM protocol		*	Hydrometeorological Parameters /Climate and Hydrology Monitoring
NMP	NMP		*	Water Level Measurements
Monthly or less	Basin Wide survey/case study/NMP		*	Water Level Measurements (Remote Sensing/Radar Altimetry)

OP): The possible national parameters or “Optional Parameters (OP)”. These parameters may be implemented on the basis of national monitoring programme framework.

OB: The most key transboundary parameters which are “Obligatory (OB) ” and must be implemented by each member states within the framework of agreed EMP,

SOS: Key transboundary parameters /study should be measured by Remote Sensing (RS) under specific programme “Specific Obligatory Survey-SOS”

NMP: Based on National Monitoring Programme/System

### 3-2-4- Geographical Coverage, Locations and Frequency

According to proposed type of monitoring in table 3-2 to 3-6, the following areas/stations are proposed to be covered in EMP:

- 1) **Sediment:** The EMP for pollution monitoring in sediment (OB parameters in sediment), will cover the entire Caspian Sea coastal area, mostly in shallow waters, but the coverage area could be expanded up on experience would gain by the states in the future. At the beginning or phase 1, at least 5 to 8 stations are proposed for each Caspian States sector, but the number of stations can be increased based on each member states interest . In addition a deeper reference station (down to 100 meters deep, where possible) will be sampled by the member states too . The proposed location for sediment sampling are presented in table 3-7 . These stations being selected on the basis of experience achieved during implementation of UNDP/GEF Regional Pilot Pollution Monitoring Programme (RPMP) in 2006. The annexed tables provide the complementary stations proposed by the countries (except I.R.Iran) which are based on monitoring programme of TACIS CaspianMap projects (RWQMP).
- 2) **Water:** The water monitoring stations for OB parameters will be the same as the sediment stations locations indicated in table 3-7. The water stations for OP parameters will be the stations designated in National Monitoring Programme (NMP) or the proposed water sampling stations presented in annexed tables .
- 3) **Mnemiopsis leidyi (MI):** The proposed locations/Stations for study of population and dynamics of *Mnemiopsis leidyi*(MI) at the beginning of phase 1 will be similar to CEP-II Monitoring study on *Beroe ovata* (BO) and *Mnemiopsis leidyi* (MI) conducted during 2005 in the Southern part of the Caspian Sea. This could be verified/optimized in future according to the experience /results gained by the time.
- 4) **Anomalous Bloom (AAB):** The proposed geographic area for Eutrophication / Anomalous Algal Bloom (AAB) Monitoring will be similar to CEP-II Anomalous Algal Bloom –AAB studies using remote sensing technique during 2005-2006 for mapping of both Sea Surface Temperature (SST) and Chlorophyll. Any changes or verification in future will be made up on the results gained by the time
- 5) **Hydrometeorology/Climate and Hydrology:** No specific design will be needed. The existing national hydrometeorological stations /network or The network under the CASPCOM protocol /provisions are proposed .
- 6) **Sea level:** No specific design will be needed. The existing national Sea level observation stations /network are proposed.
- 7) **Biology/Fish :** No specific design will be needed . The related ongoing National Monitoring /investigation on biology, fish and fish catch are proposed.

Table3-7: Proposed sediment sampling station for the Caspian phase 1 of EMP\*

Longitude	Latitude	Country	Station	No
48°53'42"	41°42'37"	AZ	Mugtadir 1	1
48°52.86"	41°40.85"	AZ	Mugtadir 2	2
48°43'45"	41°46'41"	AZ	Mugtadir 3	3
49°29'24"	39°25'15"	AZ	Kura river delta 1	4
49°30'14"	39°17'10"	AZ	Kura river delta 2	5
49°26'16"	39°10'30"	AZ	Kura river delta 3	6
49°23'25"	38°55'12"	AZ	Kurdili	7
48°55.566'	38°23.010'	IR	IS5-1	1
50°10.729'	37°24.212'	IR	C6	2
51°55.987'	36°37.310'	IR	IS7-2	3
53°13.749'	36°55.697'	IR	D8	4
53°42.000'	37°17.000'	IR	D3	5
47°46'55.57"	43°55'36.21"	RU	Lopatin	1
47°45'12.91"	43°53'41.41"	RU		
47°48'07.06"	43°53'41.41"	RU		
47°46'55.57"	43°55'36.21"	RU		
47°32'47.07"	43°36'17.30"	RU	Terek	2
47°32'27.86"	43°35'04.43"	RU		
47°34'16.54"	43°35'04.43"	RU		
47°35'13.32"	43°36'17.30"	RU		
47°33'51.31"	43°15'51.00"	RU	Sulak	3
47°33'12.30"	43°14'07.09"	RU		
47°35'49.64"	43°13'43.56"	RU		
47°36'28.28"	43°15'33.00"	RU		
47°30'00.00"	43°02'00.00"	RU	Makhachkala	4
47°32'00.00"	42°59'00.09"	RU		
47°34'00.00"	42°59'00.09"	RU		
47°32'00.00"	43°02'00.00"	RU		
47°46.8'	45°23.7'	RU	Iskustvenny Is.	5
48°01'	45°37.7'	RU	Gandurinsky Ch.	6
48°16'	45°41.4'	RU	Kirovsky Ch.	7
49°08'	46°15'	RU	Obzhorovsky Ch.	8
		RU	p. Olya	9
52°54.7'	39°58.7'	TK	Station 3	1
52°53.0'	39°55.0'	TK	Station 4	2
52°56.8'	39°51.1'	TK	Station 35	3
53°03.0'	40°02.0'	TK	Station 30	4
53°03.0'	40°03.7'	TK	Station 25	5

Alternative to the stations proposed in this table , may be replaced by selecting of 5-8 stations proposed by the EU/TACIS "RWQMP" for each CIS countries (see the annexed tables)

### 3-3- Common Guideline for Survey/Observations, Sampling, Sample Handling and Analyses for Caspian EMP

At present, there is no regionally agreed common guideline for implementation of EMP in the Caspian Sea. As far as the Phase-1 of EMP is concerned, fortunately the region has successfully experienced using common guideline / methodology during CEP-II for implementation of the following monitoring programme which will cover the needs of proposed monitoring programme in the Phase 1 of EMP including;

- ✓ Methods for Sediment Sampling and Contaminant Analysis. This guideline exclusively developed by IAEA Marine Environment Laboratory (MEL), supported by CEP-II, training was held and applied by the Caspian littoral states for implementation of Regional Pilot Contaminant Monitoring Programme in Caspian Sea in 2005;
- ✓ Report on monitoring study of *Beroe ovata* and *Mnemiopsis leidyi* in the Southern Caspian conducted with the support of CEP-II in 2005;
- ✓ The report on Anomalous Algal Bloom – AAB /SST studies using remote sensing technique, conducted with the support of CEP-II in 2005.
- ✓ In addition to above mentioned methodology / guidelines, Table 3- 8 provides the supplementary methodology and guidelines that potentially could be used for proposed EMP Phase 1.

However, the Contracting Parties should develop their own common regional guideline in future (phase 1) according to the EMP needs which will gradually cover a wide ranges of monitoring activities and disciplines. There are certain guidelines developed by the national, regional or international organizations that could be used as a basis for the development of a specific common guidelines for the Caspian Sea. At any case, the methodology of the guideline must have the highest compatibility with the latest findings, be internationally acceptable, and periodically reviewed with a view to being updated and improved.

### 3-4- QA/QC Procedures and Reference Laboratory for Caspian EMP

A good quality assurance / quality control system must be established based on a regional agreed mechanism. As indicated in table 3-1, the quality management schemes (QA/QC) must be established during phase1. This requires commitments from all levels of the organization, sufficient resources and effective quality management and quality control procedures. Moreover, quality management should not be limited only to the laboratory analyses, but the principle must be applied throughout sampling, sample handling, preparation, analyses and reporting.

At the level of an individual analyst or organization, common in-house quality control protocols need to be established. Quality management at this scale requires good laboratory

housekeeping practices, adherence to standard methods for sample collection and analyses, maintenance of well-calibrated equipment and instruments in a verifiable manner and the careful use of Certified Reference Materials during sample preparation and analysis.

As far as the phase1 of EMP is concerned, as a interim solution this procedure can be followed by the common methodologies and guidelines presented in Table 3-8, but in future a specific regionally agreed guideline/guidelines must be developed, and periodically reviewed with a view to being updated and improved. In this connection the list of recommended “Responsible National Institutions/Laboratories” for “Maintenance and Quality Management of Analytical Laboratories” in each member states are given in Table 3-9 . That would be a part of institutional arrangements for EMP implementation at national level.

It should be noted that the EMP will be implemented by the Contracting Parties using several institutions and laboratories. In addition to common in-house quality control protocols, a more demanding quality management scheme is necessary in order to ensure that all data are in comparable quality and will be unconditionally acceptable by other users / countries.

External assistance is often desirable to ensure objectivity and transparency in the interlaboratory comparisons. It is highly recommended that the caspian sea countries collectively recognize a well known international laboratory “Reference Laboratory” (preferably IAEA/MEL/Monaco - <http://www.iaea.org/monaco/page.php?page=2120>) to ensure that compatibility of laboratories in the region in producing of acceptable quality contaminant data are met. In addition, participation of national laboratories or the region in QUASIMEME programme "Quality Assurance of Information for Marine Environmental Monitoring in Europe ( <http://www.quasimeme.org/> ) for improving of national laboratories performance also is recommended.

In future the member states may establish a competence of testing and calibration laboratory/laboratories in the region (for example comply with ISO 17025). On the basis of assessment made by CEP and Tacis on national laboratories performance, in general the results from the exercises in the region have indicted that the laboratories may produce relatively good data for total petroleum hydrocarbons but have problems with the analysis of chlorinated pesticides, PCBs and other chlorinated hydrocarbons measurements. Therefore as mentioned in above, external assistance to improve nationally laboratories performance is highly recommended.



Table 3-8 Proposed common methodology /guideline for observation, sampling, sample handling and analyses in EMP phase 1

Supplementary/sample proposed methodology/ guidelines	Main proposed common methodology/ guideline	Type of Monitoring according to table 3-2 to 3-6
<ul style="list-style-type: none"> <li>Reference Methods for Marine Pollution Studies (RSRM) at <a href="http://www.unep.ch/regionalseas/pubs/rstrm.htm">http://www.unep.ch/regionalseas/pubs/rstrm.htm</a></li> <li>Technical Bulletins for Marine Pollution Studies (RSTB) at <a href="http://www.unep.ch/regionalseas/pubs/rstb.htm">http://www.unep.ch/regionalseas/pubs/rstb.htm</a></li> <li>Methodic Guidelines, 1996, Detection of pollutants in bottom sediments samples and on suspended solids, RD 52.10.556–95, Roshydromet, Moscow, 50 p. (in Russian)</li> <li>GEF GUINEA CURRENT LARGE MARINE ECOSYSTEM PROJECT. MARINE POLLUTION MONITORING MANUAL, 2009.</li> <li>ROPME. (1999).Manual of Oceanographic Observations and Pollutant analysis Methods (MOOPAM), published by Regional Organization for Protection of the Marine Environment ( ROPME ), Kuwait</li> </ul>	<ul style="list-style-type: none"> <li>Methods for Sediment Sampling and analysis developed by IAEA Marine Environment Laboratory for CEP-II Caspian Sea Regional Pilot monitoring , available at: <a href="http://www.caspianenvironment.org">www.caspianenvironment.org</a></li> <li>de Mora, S. and M.R. Sheikholeslami, 2002. ASTP: Contaminant Screening Programme, Final Report, available at: <a href="http://www.caspianenvironment.org">www.caspianenvironment.org</a></li> <li>World Bank. Ecotoxicological Study: Investigation into Toxic Contaminant Accumulation and Related Pathology in the Caspian Sturgeon , Seal and Bony Fish, available at: <a href="http://www.caspianenvironment.org">www.caspianenvironment.org</a></li> </ul>	<ul style="list-style-type: none"> <li><b>Pollution hydrochemistry and Nutrient Monitoring</b></li> </ul>
<ul style="list-style-type: none"> <li>CEP 2001:Methodology for the Mnemiopsis Monitoring in the Caspian Sea. <a href="http://caspian.iwlearn.org/caspian-1/mnemiopsis-leidy-1/methodology-for-the-mnemiopsis-monitoring-in-the-caspian-sea">http://caspian.iwlearn.org/caspian-1/mnemiopsis-leidy-1/methodology-for-the-mnemiopsis-monitoring-in-the-caspian-sea</a></li> </ul>	<ul style="list-style-type: none"> <li>CEP (2005) Monitoring study of <i>Beroe ovata</i> and <i>Mnemiopsis leidyi</i> in the Southern Caspian Final Report, available at: <a href="http://www.caspianenvironment.org">www.caspianenvironment.org</a></li> </ul>	<ul style="list-style-type: none"> <li><b>Population and dynamics of <i>Mnemiopsis leidyi</i> (MI)</b></li> </ul>
<ul style="list-style-type: none"> <li>SeaDAS Training Manual. Ocean Biology Processing Group October 29, 2007. <a href="http://oceancolor.gsfc.nasa.gov/.../SeaDAS_Training_Manual.pdf">http://oceancolor.gsfc.nasa.gov/.../SeaDAS_Training_Manual.pdf</a></li> </ul>	<ul style="list-style-type: none"> <li>CEP(2005-2006): Anomalous Algal Bloom –AAB studies using remote sensing technique , available at: <a href="http://www.caspianenvironment.org">www.caspianenvironment.org</a></li> </ul>	<ul style="list-style-type: none"> <li><b>Anomalous Algal Bloom (AAB)/ chlorophyll &amp; SST Monitoring</b></li> </ul>
<ul style="list-style-type: none"> <li>ROPME. (1999).Manual of Oceanographic Observations and Pollutant analysis Methods (MOOPAM), published by Regional Organization for Protection of the Marine Environment ( ROPME ), Kuwait,</li> <li>Regional Seas related manual/guideline</li> <li>WMO manual /Guidelines</li> <li>CASPCOM protocols</li> </ul>	<ul style="list-style-type: none"> <li>National Guidelines</li> </ul>	<ul style="list-style-type: none"> <li><b>Hydrometeorological /related to Climate and Hydrology Monitoring</b></li> </ul>
<ul style="list-style-type: none"> <li><i>P.P. Shirshov Institute of Oceanology and etal: SATELLITE ALTIMETRY OF THE CASPIAN SEA</i></li> <li><i>Caspian sea level from Topex-Poseidon altimetry:</i> <a href="http://sealevel.colorado.edu/content/caspian-sea-level-topex-poseidon-altimetry-level-now-falling">http://sealevel.colorado.edu/content/caspian-sea-level-topex-poseidon-altimetry-level-now-falling</a></li> </ul>	<ul style="list-style-type: none"> <li>National Guidelines</li> </ul>	<ul style="list-style-type: none"> <li><b>Sea level</b></li> </ul>

### 3-5- Proposed Institutional Framework for Caspian EMP

#### 3-5-1- Regional Networking and Responsible Bodies

At the beginning (phase 1 of EMP), the Secretariat to the Tehran Convention shall establish a new defined project/programme for the implementation of the EMP. This may be funded by the international agencies/Contracting Parties. During this stage the Contracting Parties shall select one or several institutions in the region as “Center of Excellence(s) to lead the EMP in various disciplines in the region for the long term. The final agreed mechanism for regional networking of EMP will be decided at this phase. The proposed regional EMP network in phase1 will be comprised of the national bodies including:

- ✓ Main National Responsible Authority for EMP management, financing and coordination;
- ✓ Organization responsible for field investigation (sampling facilities requirements, maintenance of the observational network and vessels) ;
- ✓ Laboratory needs (specialized institutions both for analytical and biological analysis of the samples including QA/QC procedures and reference laboratory, and
- ✓ Data management and reporting.

#### 3-5-2- Main National Responsible Authorities for the EMP Management, Financing and Coordination

Each Caspian littoral states benefits certain institutional arrangements, which in case of Iran may differs considerably from the other Caspian littoral states. During past few years substantial restructuring and changes of the environmental institutional framework have taken place in each of the Caspian littoral states. Non of the Caspian littoral states have single ministry, department and laboratory responsible for monitoring of the Caspian Sea. Therefore a well-coordinated mechanism is necessary among responsible authorities in each Caspian littoral state to integrate their activities in a compatible way with EMP.

*On the basis of past experiences, a possible and practical mechanism is using the National Focal Institute of the CEP as the main national responsible and coordinating body in each country. Therefore, each national focal Institute will play a node for harmonization of national and regional EMP related activities. In this context, any possible changes and restructuring of involved institutions in future at national level, will be the responsibility of the National Focal Institution.*

According to the several surveys conducted by the UNDP/GEF/CEP and EU/TACIS in the region, the main responsible organizations in each of the Caspian littoral states for management, financing and coordination are proposed in Table 3-9.

### **3-5-3- National Organizations Responsible for Field Investigation (Sampling facilities requirements, maintenance of the observational network and vessels)**

The surveys conducted by CEP and EU/Tacis have indicated that all each Caspian littoral state enjoys various level of facilities and equipment, which are sufficient to conduct the first phase of EMP where the covered area is coastal shallow water with limited number of sampling station. As far as the needed research vessel is concern, the sampling stations are located in shallow coastal waters to a maximum depth of 30 meters, it means at first stage, there is no need to allocate a large vessel for implementation of EMP. Normally 2 to 4 scientists will be able to cover the sampling job in a suitable small and safe scientific vessel. In future the countries should scale up their facilities and equipment compatible with the expanded monitoring programme. Table 3-9 shows the proposed main responsible organizations in each of the Caspian littoral state for field investigations.

### **3-5-4- Laboratory Needs and National Responsible Laboratory/Laboratories for the Caspian EMP**

The sustainability of a monitoring programme largely depends on the well-equipped laboratories for those are directly responsible for the Caspian region (coastal area) rather than those national qualified laboratories that their involvement and function can not be assured in EMP implementation. Several surveys were carried out by the CEP and EU/Tacis to evaluate the laboratories dealing with marine or environmental monitoring. The survey considered laboratory infrastructure, sampling equipment, instruments, parameters measured, manpower, and QA/QC procedures. While it was recognized that there is a number of qualified laboratories in the region, but their effective involvement in Caspian monitoring programmes are unclear and often undefined at national level. Table 3-9 presents proposed national laboratories/institutions that can be utilized by the respective country for implementation of the Caspian EMP.

### **3-5-5- National Responsible Body/Bodies for Data Management and Reporting for the Caspian EMP**

Responsible data management and reporting might be distributed among various national authorities depending on the type and diversity of data and information monitored in EMP. Therefore, coordination among national authorities to ensure proper data management and reporting will be more important in which the responsible national body should be accountable to a Regional Body in accordance with agreed and regionally approved standard protocol for reporting. In this connection role of the main responsible organization for coordination ( National Focal Institute) is crucial. Table 3-9 shows the main responsible organizations in each of the Caspian littoral state for data management and reporting of Caspian EMP.

### **3-5-6- Regional Data Base, Data Exchange of and Access to Information**

A comprehensive database and information management system will serve as a repository for relevant, available data, act as the technically sound basis for rational decision-making, and serve as a source of information for specialists, administrators, educators, and the general public.

Currently data and information of former CEP Projects and international expeditions at the Caspian region over last 10 years are available in the Data and Information Management Center (DIM) of the CASPECO Project. The produced EMP data or any other data and information for exchange or access among the member states will take place through the improved existing regional data base (Caspian Information Centre "CIC" according to Article 21 of the Convention). The final location of regional data base will be finalized in phase 1 of EMP (as a center of excellence or any other mechanism ).

### **3-6- Research Needs**

The research may include pilot studies: investigations of hot spots, examining pollutants not covered in the regional plan, sensitive habitat survey , including more biological indicators, evaluating new techniques such as biomarkers, investigating emerging pollution and other environmental issues which finally will prepare the ground for improvement of EMP for the next phases.

### **3-7- Evaluate and Refocus Monitoring Programme**

The primary focus in EMP phase1 is the measurements of key regional parameters. Periodical evaluation of implemented EMP is necessary for adaptive management, corrective action and improvement of EMP for the next phases. The evaluation should consider the results and new findings of research activities.

Table 3.9: Proposed national responsible organizations /institutions for implementations of Caspian Sea EMP (Obtained from EU/ Tacis RWQMP project and amended by including the Iranian responsible Institutions / organization)

<b>Data management Environmental state Impact assessment / and Reporting</b>	<b>Maintenance and Quality management of analytical laboratories</b>	<b>Maintenance of the observational network and vessels</b>	<b>Main Responsible Organization (Program management, financing and coordination)</b>	<b>Country</b>
National Monitoring Department + Caspian Complex Environmental Monitoring Administration + Scientific Research Institute of Fishery	Labs of the National Monitoring Department + of the Caspian Complex Environmental Monitoring Administration + Scientific Research Institute of Fishery	Caspian Complex Environmental Monitoring Administration + Scientific Research Institute of Fishery	Ministry of Ecology and Natural Resources	<b>AZ</b>
DOE( associated provincial centers) + IR Fisheries Research Organization (associated provincial centers)	DOE + IR Fisheries Research Organization (associated provincial centers) + INCO**** + Food and Drug Lab of Ministry of Health	DOE( associated provincial centers) + IR Fisheries Research Organization (associated provincial centers)	Department of the Environment (DOE)	<b>IR- IRAN</b>
Caspian Monitoring Center of KazHydromet**	Atyrau Regional Lab. KazHydromet + Partners in Atyrau and Aktau	KazHydromet + Partners in Atyrau and Aktau	Ministry of Environmental protection	<b>KZ</b>
«SOI» (Moscow) + Caspian Research Center (Astrakhan)	Regional Labs & “Center for Environment Chemistry” (“Typhoon”)	Dagestan and Astrakhan Hydromet Centers	Ministry of Natural Resources & RosHydromet	<b>RF</b>
Caspecocontrol Academy of Science Turkmenistan Rep.	Caspecocontrol	Caspecocontrol	Ministry of environmental Protection	<b>TK</b>

(1) \*\* KazHydromet: This center is under creation, a decision about its creation is already done by KazHydromet Authority and Ministry of Environment Protection of Kazakhstan Republic.

(2) \*\*\*INCO: Iranian National Center for Oceanography

## Annexes: Complementary Sampling Stations For EMP Proposed by the EU/TACIS RWQMP

As it was described in section 3-2-4, at least 5-8 stations proposed for sediment sampling. The following sediment sampling stations recommended by the EU/Tacis in "RWQMP" also could be selected and replaced with stations proposed in table 3-7 as obligatory sediment contaminant monitoring stations in each CIS countries for the Caspian EMP. The other stations proposed by the EU/TACIS (for water or sediment) may remain unchanged if the countries accept to include them in their NMPs as optional (OP). The proposed stations for IR- Iran presented in Table 3-7.

### Caspian Water Quality Monitoring and Action Plan for Areas of Pollution Concern: TACIS/2005/109244

**Tables 5.1. from RWQMP: Recommended water and sediment sampling program for the Caspian Sea Regional Monitoring Program (RWQMP)**

№ station	№ station during Cruises	Depth м	Area of monitoring studies, where sampling stations are recommended	Approximate coordinates	Related potential sources of impact	Com-ment
1*	2**	3	4	5	6	7***
<b>Azerbaijan sector</b>						
A-1C	0	10-15	Baku bay, coastal zone		Municipal waste water and Oil refinery facilities	
A-2C	1S	5-10	Baku Bay, Seaport and Oil terminal area	40°18'403 " 49°55'499"	Seaport, Oil shipment and accumulated oil fractions at the bottom of the Bay	D
A-3C	2N	11	Dubendinsky Oil Terminal	40°13'539" 50°26'292 "	Oil Exploration area at the Absheron site and Dubendinsky Oil Terminal	D
A-4M	9N	33	Pirallaly island	40°27'347" 50°36'456"	Oil exploration area of impact	D
A-5M	3N	75	Sumgait spot check	41°05'047" 49°29'291"	Open sea area under potential impact from Sumgait Industrial zone	D
A-6C	4N	23	Sumgait coastal near shore zone	40°44'023" 49°42'527"	Close area of potential impact area from Sumgait Industrial and municipal zone	
A-7B	8N	615	Jalama deep station	41°42'070" 49°04'574 "	Deep station transboundary	D
A-8T	7N	90	Jalama costal station	41°42'065" 48°55'574"	Transboundary tasks . Samur river impact area	D
A-9M	2S	9,5	Nargin island	40°17'403" 49°55'501"	Potential impact of the Oil exploration area "Oil stones"	D
A-10M	4S	550	Deep water	39°46'397" 50°11'502"	Background observation stations	D
A-10C	6S	53	Open sea	39°40'397" 49°46'497"	Open sea are of impact from the Shirvand waste water discharges point in to the sea	D
A-12C	12S		Marine part of Kura River avandelta	39°15'392" 49°31'495"	Close area of the Kura River inlet area of impact	D
A-13B	8S	630	Deep water	39°04'391" 49°51'498"	Far area of the Kura river solids sedimentation in the deep sea	D
A-14T	10S	28	Lenkoran- coastal	38°51'388" 49°13'492"	Transboundary monitoring station (Azerbaijan-Iran sector of the Sea)	

Kazakhstan sector						
1*	2**	3	4	5	6	7***
KZ-1T	0		Transboundary station		Transboundary area (Kazakhstan-Russia Federation)	D
<b>KZ-2C</b>	12	4,6	Ural River (avandelta) Peshnoy	46 <sup>0</sup> 45,994 51 <sup>0</sup> 27,998	River water Влияние стока р. Урал	D
KZ-3M	11	6,2	Zhastar	46 <sup>0</sup> 18,986 51 <sup>0</sup> 05,014	Exploration Zhastar area of impact	
<b>KZ-4M</b>	10	9	Satpaev	45 <sup>0</sup> 43,969 50 <sup>0</sup> 36,001	Satpaev exploration area of impact	D
<b>KZ-5M</b>	9	4.5	Zhemchuzhniy island	45 <sup>0</sup> 22,010 50 <sup>0</sup> 17,998	Area of integrated impact to the Semi-natural state of the marine environment	
<b>KZ-6C</b>	8	2.5	Island Kulaly	45 <sup>0</sup> 02,874 50 <sup>0</sup> 01,286	Oil Exploration Area of impact	
<b>KZ-7C</b>	6	23	Cross-Sect Mangyshlak - Chechen	44 <sup>0</sup> 30,812 49 <sup>0</sup> 48,007	Monitoring station according bi-lateral agreement between RosHydromet and KazHydromet	D
<b>KZ-8C</b>	5	28	Cross-Sect Mangyshlak - Chechen	44 <sup>0</sup> 23,492 49 <sup>0</sup> 24,786	Monitoring station according bi-lateral agreement between RosHydromet and KazHydromet	D
KZ-9C	14	4	Kalamkas- Karajambas	45 <sup>0</sup> 18,156 51 <sup>0</sup> 18,293	Area of potential impacts of obsolete oil wells being inundated at the near shore zone	
KZ-10C	15	11	Bautino Port	44 <sup>0</sup> 35,793 50 <sup>0</sup> 16,194	Sea Port influence area	D
KZ-11C	3	11	Aktau Port	43 <sup>0</sup> 35,991 51 <sup>0</sup> 11,016	Sea Port influence area and area of city municipal activity impact	D
<b>KZ-12C</b>	4	71	Aktau, open sea	43 <sup>0</sup> 34,454 50 <sup>0</sup> 52,459	Station of the deep see. Background natural conditions of the water pollution	D
KZ-13C	1	17	Cape Peschany -1	43 <sup>0</sup> 08,517 51 <sup>0</sup> 13,993	Coastal area	
<b>KZ-14B</b>	2	70	Cross-sect Peschany-2	43 <sup>0</sup> 01,830 50 <sup>0</sup> 54,656	mn +/ckground natural conditions of the water pollution.	D
KZ-15T		20	Kara-Bogaz , coastal.		Transboundary area between TM and KZ sectors of the Sea	D

Russian sector						
1*	2**	3	4	5	6	7***
RF-1M	1	2-3	Border with Kazakhstan sector of the sea	45° 54,564' 49° 16,052'	Transboundary tasks for observation	D
RF-2	2	1,5-2	Volga River Delta	46° 03,192' 49° 04,232'	Obzhorsky canal	
RF-3C	3	3	Volga River Delta	45° 47,068' 48° 51,260'	Belinsky canal	D
RF-4	4	1,5 2	Дельта р. Волга	45° 23,119' 48° 01,484'	Kirovsky canal	
RF-5C	5	1.5-3	Волго-Каспийский канал	45° 20,485' 47° 43,355'	Major shipping canal "Volga-Caspian Sea"	
RF-6		4	Kizlyar bay	43° 57,019' 47° 33,012'	Sedimentation area of solids inlet by the Terek River	D
RF-7C			Volga River Astrakhan city	46° 18,063' 47° 58,212'	Area of impact from Astrakhan Industrial and recreation zone	
RF-8C	8	2	Terek River Estuary.	43° 35,519' 47° 33,215'	Terek river inlet area of impact	D
RF-9	10	8	Sulak River Estuary	43° 50,100' 47° 35,046'	Sulak river inlet area of impact	D
RF-10C	11	8	Makhachkala, coastal zone	42° 59,278' 47° 32,075'	Makhachkala city and Oil SeaPort Terminal area of Impact	D
RF-11		11	Caspiysk town, coastal zone	42 51,800' 47 46,202'	Caspiysk town municipal waste water impact area	
RF-12		22	Izerbash town, coastal zone	42 34,736' 47 55,188'	Iserbash town municipal waste water impact area	D
RF-13	15	11	Derbent town, coastal zone	42 03,364' 48 20,183'	Derbent town municipal waste water discharges and industrial impact area	
RF-14T		10	Samur River	48 30,222' 41 55,237'	Samur River area of Impact . Transboundary station AZ-RF	D
RF-15C	16	12	Cross sect Chechen-Mangyshlak	43 58,500' 48 03,000'	Open sea monitoring. Sea water exchange between north and central part of the Sea	
RF-16	17	21	Cross sect Chechen-Mangyshlak	44 09,000' 48 38,000'	Open sea monitoring. Sea water exchange between north and central part of the Sea	
RF-17M	18	26	Cross sect Chechen-Mangyshlak	44 23,500' 49 24,500'	Open sea monitoring. Sea water exchange between north and central part of the Sea	D
RF-18	19	26	Cross sect Mahachkala- Sagyndyk	43 07,000' 47 54,000'	Background monitoring at the Central Caspian gyre area	
RF-19M	20	47	Cross sect Mahachkala- Sagyndyk	43 22,000' 48 44,000'	Background monitoring at the Central Caspian gyre area	D
RF-20	21	30	Cross sect Mahachkala- Sagyndyk	44 00,000' 49 00,000'	Background monitoring at the Central Caspian gyre area	
RF-21B	14	122	Reference station	42 30,000' 48 40,000'	Natural condition and Regional Impact area	D



Turkmenistan Sector						
1*	2**	3	4	5	6	7***
TM-1C	5	3-5	Turkmenbashi SeaPort	costal	SeaPort and OilPort areas of impact	D
TM-2C	6	5-6	Turkmenbashi Bay	39°59'605" 52°54'680"	Area of municipal waste water Potential impact from Saymonov Bay	
TM-3C	--	3	Turkmenbashi, Avaza	Coastal	Coastal area near Resort Avaza	
TM-4C	8	7,5	Cheleken 1	39°16'104" 53°02'959"	Area of the Cheleken Industrial area potential impacts	D
TM-5T	7	11	Cheleken 2 - Osushnoy	39°39'572" 53°10'021"	Area of integrated impact from Cheleken and Turkmenbashi OilTerminal	D
TM-6T	1	72	Bekdash – Karabogaz	41°20'109" 53°15'045"	Transboundary area between TM and KZ sectors of the Caspian Sea	D
TM-7T	4	62	Livanov (banka) Shallow	38°46'067" 52°18'770"	Oil and Gas exploration site area of impact (Dragen-Oil)	D
TM-8 M	9	40	Zhdanov (banka) Shallow	39°27'455" 52°41'155"	Oil and Gas exploration site area of impact (Dragen-Oil)	D
TM-9 B	10	80	Cross sect Ogurchinskiy 1	39°10'827" 52°14'066"	Deep Sea area station for assessment of background level of pollution	D
TM-10 M	11	30	Cross sect Ogurchinskiy 2	39°00'095" 52°49'994"	Open see station	D
TM-11M	12	10	Cross sect Ogurchinskiy 3	39°59'896" 53°01'307"	Coastal Sea station	
TM-12B	15	11	Okarem 2	38°00'013" 53°00'071"	Coastal Sea area station for assessment of background level of pollution	D
TM-14T	16	-	Etrek river		Transboundary monitoring station (Turkmenistan-Iran)	D

#### Comments:

The rows marked by color in the Table relate to the sampling stations, which are agreed as national priority for RWQMP, while the non-colored rows marked stations recommended to include into the national extended national monitoring

\*) Labeling of stations related to the Turkmen sector of the Sea (TM), serial number, and also an index that reflects the nature of the potential source of pollution such as "C" (coastal and land based); sea borne (M-marine); stations where observation on trends of a natural background of pollution of the sea waters (B-background) and also stations related to the tasks on transboundary monitoring (T-transboundary).

\*\*) Numbering indicated sampling stations at Kazakhstan sector of the Caspian Sea during Cruise in 2008

\*\*\*) At the stations marked as "D" sediment samples are to be taken in addition to water samples.