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REGULATORY BASIS OF ENVIRONMENTAL IMPACT ASSESSMENT CURRENT ENVIRONMENTAL STATUS METHODOLOGICAL ASPECTS OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT ASSESSMENT METHODOLOGICAL ASPECTS OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT ASSESSMENT			
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INTRODUCTION

This document presents the methodological approaches to impact assessment used during the development of Environmental Impact Assessments for the Kashagan Field Development Experimental Programme. The following impact methodologies are presented:

- Part I. Methodological aspects of environmental impact assessment.
- Part II. Methodological aspects of socio-economic impact assessment.

For a long time in the Republic of Kazakhstan the assessment of anticipated environmental impact from a project has concentrated on the environmental components, such as: atmospheric air, water and ground resources, vegetation and fauna, etc. To a great extent, such position was determined by the fact that analysis and assessment of socio-economic impacts were not supported by appropriate rules and standards in the national legislative base. At the same time, it is clear that a full environmental assessment should consider the social and economic consequences of any anticipated activity, as well as consequences of an impact on the natural environment.

An attempt has been made for the first time to harmonise the approaches both in terms of a domestic assessment and with regard to international best practice.

The methodology presented for impact assessment is based on the definition of the following three parameters:

- Scale of spatial impact;
- Scale of temporal impact;
- Impact intensity.

Each parameter is rated according to a given scale with appropriate criteria that have been developed and presented for each gradation.

The semi-quantitative method of impact assessment described in this document is based on the experience of KAAE specialists, research specialists of the Republic of Kazakhstan and work experience of Agip KCO, ADL, ERM, Shell and other companies.

Both documents are likely to be reviewed and possibly modified in the near future since they are considered as live working documents. In this connection, the authors will accept with gratitude all comments and proposals aimed at improvement of the methodologies presented.

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PART I

METHODOLOGICAL ASPECTS OF ENVIRONMENTAL IMPACT ASSESSMENT

RESUME

The given document describes methodological approaches to the environmental impact assessment used in the EIA.

INTRODUCTION

The procedure of impact assessment approved in Kazakhstan is determined according to the requirements of the RoK Law “On Ecological Expert Review” and the “Interim Instruction on the Procedure of Environmental Impact Assessment of Planned Economic Activity (EIA) in the Republic of Kazakhstan”, RND 03.02.01-93, Almaty, 1993.

This document describes the methodological approaches to the assessment of environmental impact. The semi-quantitative method of impact assessment described in this document is based on the experience of KAAE specialists, research specialists of the Republic of Kazakhstan and of Agip KCO, Arthur D Little Limited, ERM, and other companies.

– GENERAL PROVISIONS

The assessment methodology is executed within the framework of the integrated volume «Methodology» of the EIA for the Kashagan Field Development Experimental Program. The document determines the structure, contents and procedure of «Environmental Impact Assessment of Planned Activity» with due account of the following:

- Environmental impact assessment of planned activity during routine operation;
- Environmental impact assessment of planned activity during abnormal (emergency) operation.

If necessary, the assessment of trans-boundary impact of the facilities located in the Republic of Kazakhstan upon the environmental aspects must be executed on the basis of interstate agreement with consideration of provisions from the "Convention on Environmental Impact Assessment in Trans-boundary Context", ESPO (Finland), 1991 which Kazakhstan has joined in October, 21, 2000.

While preparing the given methodology, documents relating to Environmental Assessment and Environmental Impact Assessment from the Republic of Kazakhstan and other international organisations have been used as guidelines and are referenced accordingly.

– TERMS AND DEFINITIONS

Acceptable risk of emergency – a risk, the level of which is accepted and justified basing on the social-economic reasons. The object operation risk can be considered as acceptable, if the society is ready to take a risk for the sake of the benefit obtained due to object operation.

Anthropogenic load - the degree of direct and indirect impact caused by human beings and their activity upon natural complexes and separate components of the environment.

Comfortable living conditions – the characteristics of the environment promoting to good health status of human beings and favourable social conditions of population living.

Cumulative impact – impacts resulting from the permanently increasing impact caused in its turn by the other former, present of sound predictable operations associated with project realization.

Determining of information content and quantity – a process of determining of content and quantity of information on the environment status to be provided to competent authorities within the framework of the EIA procedure.

Ecological justification - cumulative arguments (evidence) and scientific predictions allowing to assess the environmental hazards of the planned economic and other activities for ecosystems (natural territorial complexes) and human beings.

Ecological standard – the specific value of nature resource use or technogenic impact upon ecosystems and its separate components, following which functional-structural characteristics of ecosystems do not fall outside the limits of the natural changes.

EIA document – is a document or documents containing information about EP and EIA needed in compliance with Article 5 Directive 85/337/EEC with amendments made by Directive 97/11/EC.

EIA group - a group carrying out an assessment of the impact upon the environment and preparing information for EP and EIA for further commit to competent authorities.

Emergency damage — losses in the production and other spheres of the man vital activity, damage to the natural environment caused as a result of emergency situation at the hazard production object as well as losses equivalent in money .

Emergency hazard – the risk, the possible damage to a man, property and (or) the environment due to emergency situation at the hazard production object. Emergencies hazard at hazard production objects relate to possibility of facilities and(or) technical devices destruction, explosion and(or) hazardous substance emission with further damage to a man, property, and (or) the natural environment.

Emergency risk analysis – a process of risks identification and emergency risk assessment at the production object being hazard for some persons or groups of persons, property or the environment.

Emergency risk assessment – the process used for determining of probability (or frequency) and degree of the severity of the emergency risks consequences for population health, property and/or the environment. Risk assessment includes the analysis of probability (or frequency), analysis of consequences and their combination.

Environment Action Plan (EAP) – a document containing: a) measures to be taken in the course of project implementation and operation to eliminate or neutralize the unfavourable consequences for the environment or their reduction to the acceptable level; and b) provisions required for the given measures implementation.

Environment components - constituent parts of ecosystems: air, surface and ground waters, subsoils (including grounds, rocks), soils, plants and animals.

Environmental hazard - the possibility of worsening of the natural environment quality (status, processes), under the influence of natural and technogenic factors posing the threat to ecosystems and a man.

Environmental impact - any change of physical, natural or cultural environment resulted from the project development.

Environmental Impact Assessment - the forecast of anticipated consequences resulting from the ongoing or planned activity and their management through project development, as well as mitigation and rehabilitation measures so that any negative consequences can be minimised.

Environmental impact assessment - determining of the nature, degree and the scale of the impact caused by the object of the economic or other activity upon the environment and consequences of this impact, as well as development of proper measures on impact mitigation, management and monitoring. This is the term used in the given document for the specification of procedure meeting the requirements of the assessment in compliance with Directive 97/11/EC.

Environmental requirements – the complex of nature use limits and conditions on the environment protection in the process of the economic or other activity.

Environmental risk - a combination of probability or frequency of certain hazard occurrence and severity of consequences resulted from such event.

Environmental safety - the state of the environment providing the environmental balance in nature and protection of the environment and human beings from the hazard impact of the unfavourable factors resulted from the natural processes and anthropogenic impact, including technogenic (industry, construction) and agricultural ones.

Environmental situation – combination of conditions, processes and circumstances of natural and technical nature influencing the status of natural and natural-technique systems.

Environmental survey – surveys, carrying out by the developer and EIA team for preparation of information about the environment to be provided to competent authorities.

Identification of emergency hazards – the process of defining and admitting of fact that emergency hazards at the hazard production object exist; the process of risks characteristics determining.

Impacts interaction – reactions between the different impact types (either between the impacts of one project only or between impacts of other projects in the same sphere)

Indirect impact - Environmental impacts that result not directly (immediately) from project realization, frequently occur at some distance from project realization area or come out from complex impact. In some cases this type of impact may be referred to the second or third impact level and can also be reviewed as a secondary (side) impact.

Information about the environment (ecological information) - information about the Project and impacts upon the environment, provided to competent authorities by the project developer. The requirements to such kind of information are given in Article 5 and Appendix IV of the Directive (see Environmental Impact Assessment).

Monitoring of natural-technique systems - the system of stationary observations over the environment and facilities in the process of their construction, operation, decommissioning as well as development of recommendation on normalization of the ecological situation and engineering protection of facilities.

Natural-resource potential of the territory - a number of natural resources and conditions determining the limit of the possible use of the natural environment components with consideration of their capability for restoration; the characteristic reflecting the degree of the natural environment components participation in the satisfying of various needs of the society.

Natural-territorial complex - genetically conditioned combination of natural components forming the system of the physical-geographical formations of various hierarchic ranks.

Object of environmental risk - an object of economic or other activity resulting in an impact upon the environment of high severity and long duration and posing a threat to the life and health of population.

Project – carrying out of construction operations or other installation works accompanying by the ingress into the environment and landscape, including operations related to the mineral resources production.

Resistance of the natural systems to the impact – the capability of natural systems for preserving their structure and functional properties in the course of the natural and anthropogenic impact.

Risk management - the process of the implementation of the decision concerning the accepting or changing of risks, based on the assessment of various expense and benefits.

Screening- the process of making of the decision concerning the necessity of the EIA procedure for the certain project.

Transboundary impact – an impact resulted by the objects of the economic or other activity of one state upon the environmental status of the territory of another state.

Zone of ecological disorder - the section of the area subject to pervasive irreversible changes of the environment caused from economic or other activity and resulting in considerable worsening of the population health, biological balance disturbance, natural environmental system disturbance, flora and fauna degradation.

Zone of environmental emergency - the section of the area subject to stable negative changes in the environment resulted from economic or other activity threatening the health of population, status of the natural environmental systems, genetic heritage of plants and animals¹.

Zone of project impact - the area subject to project influence, including such its subsidiary aspects, as trunk routes of electric power lines, pipelines, channels, tunnels, transport and access roads, zones of wastes collection and disposal, temporary workers' camps, as well as unplanned operations related to project implementation (spontaneous populating, timber felling, shifting agriculture along the access roads).

– ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE

The section «Environmental impact assessment» is an obligatory component of the overall environmental impact assessment.

Environmental impact assessment of planned activity is made with application of available materials and statistical data obtained from:

- Ministry of Environment and Bioresources of the RoK and its oblast committees;
- Subdivision “Kazgidromet” RSE;
- Scientific and Research organisations;
- Other organisations.

– ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

The generalized scheme for environmental impact assessment is shown in Fig 4.1 below:

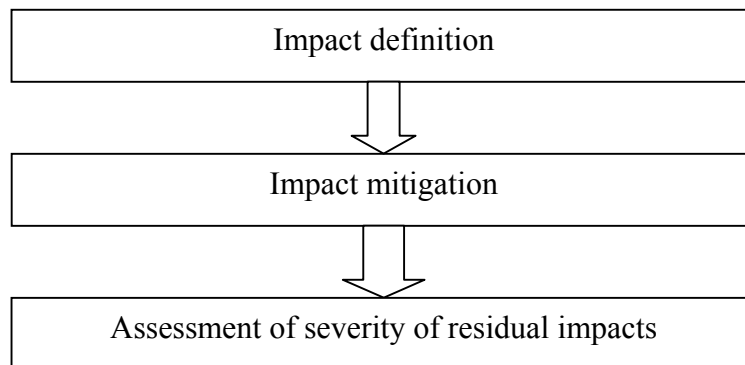


Figure 4.1 Generalised Scheme for Environmental Impact Assessment

The assessment of the potential impacts of the project upon the environment is the most important stage in the EIA process. The objective is to define what environmental changes may result from the proposed activities and assess the severity of such changes.

This assessment is based on the following:

- Project technical description;
- Understanding of the environmental components that may be affected;
- Experience from other projects.

In compliance with usual EIA practice this impact assessment is conducted for the following ecosystem components:

- Soil and subsoil;
- Surface and marine waters;
- Groundwater resources;
- Marine sediments;
- Air quality;
- Biological resources;
- Landscapes and visual impacts;
- Physical factor of impact (noise and electromagnetic impact, vibration, etc.).

a. Mitigation of Impacts

Generally the measures and provisions undertaken for impact mitigation have been established during the design of the project through the hierarchy described in Text Box 1 below.

Text Box 1: Mitigation Hierarchy for Planned Project Activities

- **Avoid at source; Reduce at source**

Avoiding or reducing at source is essentially “designing” the project so that a feature causing an impact is designed out (e.g. pipeline route changes) or altered (e.g. reduced working width). Often called minimization.

- **In-situ mitigation**

This proposes modifications to the initial project design. e.g. pollution control measures. Often called “in-end-of-pipe”.

- **Mitigation at receptor**

If the impact cannot be abated on –site then measures can be implemented off-site e.g. install double-glazed windows to minimize noise impact at nearby residences

- **Repair or Restoration**

Some impacts result in unavoidable damage of resources (e.g. damage of agricultural lands during pipeline construction). Restoration mainly proposes measures for returning the resource to its initial state.

- **Compensation**

If other mitigation measures are not possible or fully effective, then compensation for the loss, damage and the general intrusion may be appropriate. The compensation may be “in-kind”, such as planting of new woodlands elsewhere to replace what has been lost.

The consequences of the impact after mitigation measures are implemented is called the **residual impact**.

b. Residual Impact

Initially RoK experts and KAAE specialists will provide a qualitative review of the potential impact severity. Then taking into account impact mitigation measures to be implemented the residual impact will be assessed. An example of such an assessment is given in Table 4-1. In addition the type of the impact, direct or indirect, will be specified in line with the definitions shown in Text Box 2.

Residual impacts are described by RoK experts and KAAE specialists based on their experience of similar projects. The category of severity will then be assessed following the semi-quantitative methodology described below and compared with the initial qualitative . The severity assessment for residual impacts is important for the following reasons:

- To demonstrate to design engineers the necessity for appropriate mitigation measures for any potential impact.
- To inform decision making authorities, and interested parties about the residual impacts.

Table 4-1 Residual impact

Initial Impact description, Severity (High, Medium, Low), Type of Impact (direct, indirect)	Impact mitigation measures	Residual impact	
		Impact description	Severity per environmental components (High, Medium, Low), type
Impact of Trunklines on benthos. Benthos may be disturbed or may die during dredging operations Severity - high Type of impact - direct	To minimize the size of the pipeline construction corridor	Residual impact on benthos	Severity - medium

Text Box 2

Direct impact – an impact directly related to operations on project implementation and being the result of the interaction between the working operation and the receiving environment (for example, between the sewage water discharge and the quality of the water receptor)
Indirect impact – an impact related to the mediated changes of the environment being the result of other developments or working operations, stimulated by the initial development.

– EVALUATION OF IMPACTS

The evaluation of impacts in this EIA will take into consideration the mitigation measures that the Project is already committed to on the basis of work that has gone into the Front End Engineering and Design (FEED), together with those measures that would be expected as part of good international practice. To the extent possible it is the severity of the residual impacts that is being evaluated, i.e. those that remain after mitigation measures have been applied. The residual impacts are assessed as described below.

The EIA will reflect the status of the project based on available FEED information. Detail design is yet to be undertaken so further detail on the precise nature of many mitigation measures will be developed in the future. Environmental specifications, however, have been set at the FEED stage. Designers and constructors will only have discretions as to the manner in which those standards are achieved (e.g. disposal of hydro-test water). For many impacts the assessment of the severity of residual impact is based on commitments made to date by Agip KCO as specifications in FEED; this is normal for a FEED based EIA. These commitments will be taken by the Contractors and converted into the detail necessary to implement them on the ground. This will ensure that the mitigation once applied will result in impacts that are not *environmentally* greater than those predicted in the EIA.

The EIA shall also contain recommendations for additional mitigation measures (beyond current FEED commitments or as exceptions to good international practice). These recommendations will be based on the independent professional judgment of the EIA authors. It should therefore be noted that significance or severity allocated to the residual impacts in this EIA will not necessarily be identical to those described herein at the time of project implementation since further impact reduction will be investigated during detailed design for many of the impacts. Actual impacts from the final project are expected to be no greater than those described here.

a. Severity Criteria

The severity of the residual impact are assessed on the basis of:

- Impact probability;
- Impact consequence.

The assessment is made at the site, local, area and regional level. Special attention is paid to the site-wide and local levels when assessing impacts. Vulnerable resources (e. g, red book species) are also tracked.

In most assessments of environmental impact it is difficult to determine the quantitative value of the environmental change. The methodology proposed is a semi-quantitative assessment based on scores, the basis of which is presented below.

The severity of anthropogenic disturbances of the environment is assessed on the following parameters:

- Spatial scale;
- Temporal scale;
- Intensity.

For each environmental component the methodology determines the severity of each parameter based on a scale gradation between 1 and 4 for which criteria have been established based on the authors experience on similar projects and the understanding they have of the receiving environment.

For the environmental impact assessment a 4-point scale was used, whilst for the socio-economic impact assessment a 5-point scale was used. This is because an environmental

impact may emerge during an activity and cannot be assessed as having zero impact. However this is not the case with the socio-economic impact assessment where a zero impact may be observed, e.g. offshore dredging operations have a zero impact on population health. The zero environmental impact may only occur if there is a complete absence of anthropogenic activity or if the impact is related to the natural variability of the environment.

b. Definition of Spatial Scale for Environmental Impacts

Definition of spatial scale impacts are based, on technical analysis, mathematical modelling, or on the basis of expert judgment; they are presented in Table 5-1 and further described in Text Box 3.

Table 5-1 Spatial (area) gradations of environmental impacts

Scale of spatial impact	Criterion		Score I
Site	Impact area is up to 1 km ²	Impact is registered at the distance 100 m from the linear object	1
Limited	Impact area is up to 10 km ²	Impact is registered at the distance 1 km from the linear object	2
Area	Impact area from 10 to 100 km ²	Impact is registered at the distance from 1km to 10km from the linear object	3
Regional	Impact area exceeds 100 km ²	Impact is registered at the distance exceeding 10 km from the linear object	4

**Note: For linear objects areal gradations are used. If the area cannot be evaluated, the linear distance is used*

Text Box 3

Site- impact – an impact affecting the components of the environment within the territory (water area) up to 1 km² influencing the land geographical complexes at the level facies or stows*.

Limited impact – an impact affecting the components of the environment within the territory (water area) up to 10 km² influencing the land geographical complexes at the level of the groups of stows or the locality.

Area impact – an impact affecting the components of the environment, limited territories (water areas) of the object location or territories inconsiderably exceeding the object's area (up to 100km²) influencing the elementary land geographical complexes at the landscape** level .

Regional impact – an impact affecting the components of the environment in the regional scale within the territory (water area) exceeding 100 km² influencing the land geographical complexes at the level of districts or provinces.

*facies – elementary ecosystem (e.g. Sor); stow – group of elementary ecosystem (e.g. Coastal marsh solonchaks)

**landscape – group of stow (e.g.. Flood plane of the Ural river)

c. Definition of Temporal Scale for Environmental Impacts

Definition of temporal scale impacts are based on particular environmental components defined on the basis of technical analysis, analytical (modelling) assessments or expert judgment; they are presented in Table 5-2 and further described in Text Box 4.

Table 5-2 Gradation of temporal impact assessment

Scale of Temporal Impact	Criterion	Score
Short-term	Impact observed for up to 3 months	1
Medium-term	Impact is observed from 3 months to 1 year	2
Long-term	Impact observed from 1 to 3 years	3
Multiyear and permanent	Impact observed for more than 3 years	4

Text Box 4

Short-term impact – an impact observed for a limited period of time (in the course of construction, drilling or decommissioning activities), but, as a rule, disappearing after completion of operations; its duration does not exceed one season (assumed as 3 months)

Medium term impact – an impact observed for more than one season (3 months) up to one year.

Long-term impact - an impact observed for a long period of time (more than one year but less than 3 years) and covers the period of project construction

Multi-year and permanent impact– impacts is observed from 3 to 5 years and more (noise from operation) and which may be rather characterized as recurrent or periodic (an impact as a result of annual operations related to the technical maintenance). Generally corresponds to the period in which design capacity is achieved.

d. Definition of Intensity (Value/Magnitude) Scale for Environmental Impacts

The scale of intensity is defined on the basis of ecological-toxicological studies (as presented in Appendix 2) and expert judgment and is presented in Table 5-3.

Table 5-3 Intensity scale gradation for environmental impacts

Scale of Intensity impact	Criterion	Score
Negligible	Environmental changes are within the existing limits of natural variations.	1
Minor	Environmental changes exceed the existing limits of natural variations. Natural environment is completely self-recoverable.	2
Moderate	Environmental changes exceed the existing limits of natural variations and result in damage to the separate environmental components. Natural environment remains self-recoverable.	3
Major	Environmental changes result in significant disturbance to particular environmental components and ecosystems. Certain environmental components lose self-recovering ability.	4

e. Integrated Assessment of Impact from Various Impact Sources upon Particular Environmental Components

The integrated assessment is a multi step process.

Step 1: Tables presenting impact criteria (Tables 5-2, 5-3 and 5-4) are used to obtain the integrated impact score for a particular environmental component. Integrated scores are defined by the following formula¹:

$$O_{integr}^i = Q_i^t \times Q_i^s \times Q_i^j$$

where:

- O_{integr}^i – Integrated assessment score for the defined impact;
- Q_i^t – Temporal impact score for i environmental component;
- Q_i^s – Spatial impact score for i environmental component;
- Q_i^j – Intensity impact score for i environmental component;

Step 2: The category of severity is determined by the band in which the score, which has been derived from the integrated assessment calculation, falls into, as shown in Table 5-4 below.

Table 5-4 Categories of impact severity

Impact Parameters			Integrated score score	Categories of severity	
Spatial scale	Temporal scale	Impact intensity		Scores	Severity
Site 1	Short-term 1	Negligible 1	1	1- 8	Impact of low severity (negligible impact)
Limited 2	Medium-term 2	Minor 2	8		
Area 3	Long-term 3	Moderate 3	27	9- 27	Impact of moderate severity (moderate impact)
Regional 4	Multi year 4	Serious 4	64	28 - 64	Impact of high severity (major impact)

This EIA considers three categories of impact severity – negligible, moderate and major, as described in Text Box 5 below.

¹ An additive system was used in the socio-economic impact methodology due to zero values which would nullify the equation in the multiplication process for integrated environmental impact assessment.

Text Box 5

Low severity impact (negligible impact) is observed in case the consequences occur but impact is rather low (both mitigated or unmitigated) and falls within the permissible standards limits or the receptors are characterized by either low sensitivity or value. **Moderate severity impact (moderate impact)** may be characterized by a wide range that starts from the threshold value slightly exceeding the negligible impact level and ends at the level almost exceeding the legislative limits. Mitigation of moderate impact should be demonstrated if possible. **High severity impact (major impact)** is registered when permissible limits are exceeded or in case the large-scale impact is registered especially in respect of valuable/sensitive resources.

The category of severity is defined for the impact on the following environmental components:

- Soil and subsoil;
- Surface and marine waters;
- Groundwater;
- Bottom sediments;
- Atmospheric air quality;
- Marine and land biological resources;
- Landscapes;
- Physical factors (noise and electromagnetic impact, vibration, etc.).

An example of the integrated assessment is presented in Table 5-5 below:

Table 5-5 An example of the integrated assessment

Environmental Component	Sources and types of impact	Spatial impact gradation	Temporal impact gradation	Impact intensity gradation	Integrated score	Impact severity
Atmospheric air	Effect of emissions on photochemical smog formation	2 Local	3 Long-term	1 Negligible	6	Low
	Effect of emissions on acid rains formation	2 Local	2 Medium-term	3 Moderate	12	Medium
	Effect of emissions on atmospheric air quality	2 Local	3 Long-term	3 Moderate	18	Medium

– **EMERGENCY SITUATIONS IMPACT ASSESSMENT (RISK ANALYSIS)**

In compliance with ISO 17776 international standard risk analysis process includes the following basic stages:

- Hazardous industrial processes definition (screening);
- Risk assessment;
- Proposals on risk degree elimination or reduction.

a. Hazardous Industrial Processes Definition (Screening)

The principal objectives of the risk identification stage are: identification and clear definition of all industrial processes as potential risk sources, forecasting of emergency situations scenario and consequences elimination.

The potentially hazardous objects and industries are divided into the two following categories:

- Stationary objects and industries with limited area (plants, units, storage facilities, pipelines, etc.);
- Mobile objects and industries (road, rail-way and water transport).

In compliance with ISO 17776 several methods are proposed for composing the list of hazardous industrial processes:

- Experience/conclusions of experts;
- Control test tables compiled on the basis of standards and industry experience. Risk and hazard assessment should be considered for the accidents that have already occurred and have been identified and for which standard methods of hazard prevention and mitigation have been developed;
- Structural analysis.

The check-list of hazards and consequences for offshore production units in oil and gas industries is presented in the form of a supplement to ISO 17776. The extract from this supplement related to environmental risks is presented in Appendix 1.

Identification of hazards is concluded with the selection actions. The following options may be considered:

- Decision to stop the analysis since the risk is negligible or if the preliminary assessment made for a particular impact sources is sufficient;
- Decision to carry out more detailed analysis of hazards and risk assessment;
- Development of preliminary recommendations on hazard reduction.

a. Risk Assessment (QRA)

Risk assessment comprises two elements: risk assessment and risk management

Risk assessment is based on the analysis of the risk source, risk factors, peculiarities of the specific environment (biocenosis or landscape) and interaction mechanism.

Anthropogenic factors, accidental and cumulative risks are considered the basic elements of environmental risk assessment.

The first risk type is a result of an unexpected departure from the normal operation of the engineering systems associated with emission of substances and energy leading to ecosystem degradation or serious, even irreversible changes of natural processes.

The second risk type is related to similar consequences leading to local, regional and even global effects but resulting from accumulation of a series of processes in the environment during routine operation.

Peculiarities of environmental risk analysis for technologies are characterized by the fact that in the process of analysis potential negative consequences that may result from engineering system failure or malfunction, or engineering process faults by different reasons are reviewed. Risk assessment includes probability (or frequency) analysis, consequences analysis and analysis of combination of the above. The main objectives of the risk assessment stage are associated with the following:

- identification of initiating and all unwanted events frequency;
- assessment of undesirable events consequences;
- risk assessment summary.

• Definition of Emergency Situations Possibility (Frequency)

After the list of hazards subject to further detailed analysis is compiled, the frequency (possibility) of such hazards shall be determined. Probabilistic assessments made for the industry and company from the appropriate databases may be used but special attention should be paid to the adequacy of such information. However, if historical data is lacking or considered unreliable, risk analysis can be based on analogues of production process. The brief summary and comparative data related to some risk analysis methods and some risk sources classifications are presented in Appendix 7.

• Assessment of Emergency Situations Consequences

Level of pollution (obtained as a result of mathematical modelling) resulting from an actual incident may be compared with the known environmental data in order to define the environmental consequences.

Classification of environmental safety conditions subject to environmental risk level is presented in Table 6-1.

Table 6-1 Classification of environmental safety conditions

Category	Level of environmental risk / per year	General assessment of environmental safety conditions
I	$< 10^{-8}$	Environmental well-being.
II	$< 10^{-6}$	Satisfactory conditions. Normal state. Man-caused impact upon environment doesn't exceed permissible load level.
III	$10^{-5} - 10^{-3}$	Unsatisfactory conditions. Man-caused impact upon environment affects its stability. Biota degradation tendencies appear and develop.
IV	$10^{-3} - 10^{-2}$	Adverse conditions. Biota degradation is in process. Abnormal morbidity and mortality in different sexual and age groups. Social tension occurrence.
V	$> 10^{-2}$	Environmental disaster. Biota does not recover or recovery takes several generations life-time. Ubiquitous health deterioration. Abnormal mortality rate of population, tendency to extinction.

The specific assessment of emergency situations impact is defined similar to that for routine operations. Impact spatial and temporal scales, as well as intensity are determined in compliance with

Tables 5-2, 5-3, and 5-4. Taking into consideration the duration of emergency the dynamics of impact mitigation are determined, and in the case of cumulative impact the average values are estimated. Assessment is concluded with the definition of the integrated impact severity (Table 5-4) and development of emergency reduction and mitigation strategies.

b. Suggestions on Risk Elimination or Decrease of Risk

As environmental risk comprises possibility (frequency) of a particular hazard occurrence and severity of consequences of such hazard, recommendations on risk decrease should lead to:

- accident risk reduction;
- consequences minimization.

The suggested measures should be both technological and organizational.

Technological measures:

- restriction in hazardous technologies used;
- reduction of explosive and toxic substances used;
- generation of automatic control systems and design parameters (pressure, temperature, volume) support systems;
- establishment of safety zones (protection from explosion by objects separation);
- installation of processing facilities taking into account organization of routes for emergency personnel evacuation from shop floors and rescue group movements.

Organizational measures:

- development and observance of safety code regulations;
- fire protection and alarm system;
- personnel training guidelines;
- delegation of responsibility for facility safety;
- organization of toxic and explosive substances storage facilities and waste storage sites monitoring.

More detailed description of risk reduction and mitigation measures for specific types of economical activity are presented in standard-technical and guideline documentation, standards and processing facilities operating instructions.

– ENVIRONMENTAL RISK MATRIX

The Environmental risk matrix shown in figure 7.1 is based on an integrated impact assessment divided into 5 ranges.

Probabilistic ranges were taken from matrices developed by Agip KCO. If the probability of impact is low, even with high (severe impact) significance of negative impact, it can correspond to low ecological risk (tolerable risk). For routine operations the probability equals to 1.

Figure 7.1 Ecological risk matrix

Integrated assessment	Population	Environment	O	A	B	C	D	E
			$<10^{-6}$	$>10^{-6}$ to $<10^{-4}$	$\geq 10^{-4}$ to $<10^{-3}$	$\geq 10^{-3}$ to $<10^{-1}$	$>10^{-1}$ to <1	≥ 1
			Practically non-credible failure Could occur but has not necessarily been observed in E&P industry	Rare failure Has rarely occurred in E&P industry	Credible failure Has occurred in E&P industry		Probable failure May occur several times a year in operating company	Frequent failure Will occur routinely in an individual plant
1-12	Slight injury	Slight effect	Tolerable (low) risk (T)					
13-25	Minor injury	Minor effect						
26-38	Major injury	Local effect			Medium risk – compulsory impact reduction (C)			
39-51	Single fatality	Major effect						Intolerable (High) risk (I)
52-64	Multiple fatality	Heavy effect						

– ASSESSMENT OF CUMULATIVE IMPACT AND DIFFERENT IMPACTS

This section is based on the recommendations of the European Commission (EC) Guidance (EC Guidelines May 1999), which provides a definition of indirect and cumulative impacts and impact interactions.

Indirect impacts. Environmental impacts that do not result directly (immediately) from the project, occur at some distance from project area or occur from a chain of cause and effect from the project. . It may be referred to as a secondary impact .

Cumulative impacts. Impacts resulting from the permanently increasing impact caused in its turn by the other former, present or soundly predictable operations associated with project realization. While assessing the potential cumulative impacts, the impact of another projects is also assessed, the combination of which can lead to more extensive and severe impacts. Each project may have an insignificant effect on its own, but the combined effects may be considerable. This occurs particularly where, for example, air quality is already compromised in a region, but does not exceed standards and each project will not exceed the standards, but the large number or large size of new projects may push the region into non-compliance.

Interaction of various impact sources. Impacts interaction are the reactions between the different impact types (either between the impacts of one project only or between impacts of other projects of the same sphere).

Following EC Guidance assessment of indirect and cumulative impacts and different impacts interaction should not be reviewed as a separate EIA process stage. Undoubtedly, assessment of these types of impact is an integrated part of all EIA stages. The abovementioned EC Guidance provides descriptions of eight methods and instruments that were selected in the course of thematic studies and references analysis. In general the abovementioned methods and instruments may be subdivided into two main groups:

- Methods of impact review and identification – aimed at determination of the way and place of indirect and cumulative impacts and impact interactions occurrence;
- Assessment methods – used for measuring and forecasting impact scale and severity based on the study of impacts intensity and circumstances of impact occurrence and demonstration.

Combination of different methods or introduction of these approaches at different stages is allowed in the course of EIA.

a. Cumulative Impacts Assessment

Assessment of cumulative impacts comprises two stages:

- *Identification* (screening) of possible cumulative impacts (cumulative impacts screening);
- *Assessment* of cumulative impact upon natural environment components.

Identification of potential cumulative impacts is defined by the plain matrix based on table 5-4 showing the impacts upon different environmental components that have already occurred on this territory and impacts that may occur from project implementation. The matrices identify the impacts upon different environmental components occurring at different project stages (construction, operation and decommissioning).

This matrix must also define the cause of cumulative impact occurrence – extension of impact area, increase of impact duration or intensity.

Assessment of cumulative impact upon natural environment components. Assessment of impact upon particular environmental component is carried out for identified environmental components and impact sources in accordance with the method presented in this chapter for routine operations. Cumulative effect resulting from area, duration or intensity increase is considered.

Integrated impact assessment has been determined and impact significance has been identified in Table 5-4 for the results of the cumulative impact assessment for the different environmental components. Ecological risk is assessed in the Ecological Risk Matrix (Figure 7.1.).

a. Assessment of Different Impact Sources Interaction

There may be an overlap of environmental impact zones given the simultaneous operation of several impact sources. In these zones impact intensity will be high compared to impact from the single source.

In case of different impact sources, the interaction of environmental impacts is assessed in compliance with the same scheme as assessment of cumulative effects impact upon environment:

- Identification (compilation of list) of possible impact sources interaction (impacts screening);
- Assessment of impact upon natural environment components in case of different impact sources interaction.

Similar to cumulative impact assessment, identification of potential combined impacts from different sources is defined by the plain matrix arraying basing on table 4-1, where the impacts from different sources upon different environmental components are shown.

Assessment of combined impact effects upon natural environment components. Assessment of impact upon particular environmental component is carried out for identified environmental components and impact sources in accordance with the method reviewed in Chapter 3. Besides, joint effect resulting from increase of intensity in the area of combined impact of these sources is considered.

Integrated impact assessment has been determined and impact significance has been identified in Table 5-3 for obtained results of combined impact assessment of different sources as per the environmental components. Ecological risk is assessed in Ecological Risk Matrix (Figure 7.1.).

– TRANSBOUNDARY IMPACTS

Following the World Bank documents OP 4.01 transboundary impacts (impacts registered beyond the state boundaries) should be considered in the course of EIA.

Transboundary impacts may affect the following:

Atmospheric air	Pollutants transportation in ambient air
Soil	Pollutants fall-out from atmosphere during pollutants transboundary transfer in ambient air. Pollutants fall-out from atmosphere during pollutants transboundary transfer in ambient air.
Surface waters	Pollutants transportation with surface waters (a river if it crosses the border and a lake in case the border is on the lake water area)
Sea water	Pollutants fall-out from atmosphere during pollutants transboundary transfer in ambient air. Pollutants transportation with sea water
Vegetation	Potential impact upon vegetation growing in the neighbouring country caused by acid rains forming because of pollutants transboundary transfer in atmosphere.
Mammals, ornithofauna and ichthyofauna	In case of significant project impact upon migrating species if migration routes pass through other countries.
Specially protected natural territories and national parks	Potential impact upon offshore and onshore natural environment

Transboundary impacts assessment process comprises several stages:

- Stage 1. *Screening*. Environmental components of the zone that is beyond the state boundaries are selected from the impacts integrated assessment matrix for routine and non-routine (emergency) situations using the spatial impact scale;
- Stage 2. *Impact area*. The area located on the other state territory is subtracted from the total impact area;
- Stage 3. *Impact duration*. Impact duration will be permanent for routine operations (e.g. for operation period). Time period during which impact can be registered at the neighbouring state territory must be estimated for emergency situations (e.g. pollutants concentration increase in atmosphere of the neighbouring country will not be registered during the whole period of emergency and effects elimination);
- Stage 4. *Intensity score of impact upon each selected environmental component*. This score may differ from impact intensity score for the whole impact area. For instance, during the emergency situation associated with pollutants emission into atmospheric air the average concentration of one pollutant on impact area equalled 7 MPC (score 3 according to intensity scale), while on the neighbouring country territory under impact it equalled 1.5 MPC that corresponds to score 2 of intensity scale;
- Stage 5. *Spatial and temporal scale of transboundary impact and its intensity*. Either integrated impact assessment upon the certain environmental component during transboundary impact or integrated assessment of impact upon all environmental components of the neighbouring country is received. These integrated assessments may be used for alternatives' comparison.

– SUMMARY

The suggested methodological aspects of environmental impact assessment to be used for overall EIA development are presented. Methodological approaches have been developed which will be understandable to Kazakhstani experts and have been based on the regulatory requirements of the Republic of Kazakhstan and international directives that have been referenced. The methodology presented for environmental impact assessment are based on the definition of the following three parameters:

- Spatial impact scale;
- Temporal impact scale;
- Impact intensity.

Each of the impact scales is scored on a 4-point gradation. The appropriate criteria have been developed for each of gradation.

The semi-quantitative method of impact assessment described in this document is based on the experience of KAAE specialists, research specialists of the Republic of Kazakhstan and of Agip KCO, Arthur D little Limited, ERM and other companies.

The procedure for determining an integrated impact assessment for environmental components for routine operation and emergency situations is presented.

A mechanism for defining the impact severity is suggested.

The developed methodology for environmental impact assessment enables:

- the assessment of environmental impacts from different sources for both routine and non-routine (emergency) operations;
- the severity of environmental impact to be defined;
- the assessment of cumulative impact and different impact sources interaction;
- transboundary impacts to be assessed.

The suggested methodological aspects allow making certain conclusions on the assessment of impact on each environment, which is essential for State Ecological Expert Review.

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3. Environmental Assessment Sourcebook (1991) and Updates

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PART II

METHODOLOGICAL ASPECTS OF SOCIO-ECONOMIC IMPACT ASSESSMENT

RESUME

This Document determines the structure, content and order of socio-economic impact assessment of planned activity. Routine and abnormal operation.

INTRODUCTION

The procedure for impact assessment approved in Kazakhstan is determined according to the requirements of the RoK Law “On Ecological Expert Review” and “Interim Instruction on the Procedure of Environmental Impact Assessment (EIA) of Planned Economic Activity in the Republic of Kazakhstan”, RND 03.02.01-93, Almaty, 1993.

At the same time, there are no officially approved methods for social sphere impact assessment (SSIA) with respect to planned activity in planned facilities location area. A significant role in worldwide practice is given to the study of social-economic aspects in terms of their inherent interaction with environmental components. Therefore, impact criteria, as a rule, are determined by the SSIA authors with due account of certain design solutions and specifics of planned facilities location area.

This document describes the methodological approaches to the assessment of the impact on social and economic aspects with respect to the new and specific activity of offshore oil operations and associated onshore support facilities in the Republic of Kazakhstan.

1 GENERAL PROVISIONS

The present assessment is executed within the framework of the integrated volume «Methodology», which forms part of the EIA for the Kashagan Field Development Experimental Programme.

The document determines the structure, contents and procedure of section «Social Sphere Impact Assessment of Planned Activity» (SSIA) with due account of the following:

- Socio-economic impact assessment of planned activity during routine operation;
- Socio-economic impact assessment of planned activity during abnormal (emergency) operation and to the extent that impacts can reasonably be predicted.

If necessary, the assessment of transboundary impact of the facilities located in the Republic of Kazakhstan upon the socio-economic aspects may be executed on the basis of interstate agreement with regard to the provisions of the "Convention on Environmental Impact Assessment in a Transboundary Context", Espoo (Finland), 1991 which Kazakhstan joined on October 21, 2000.

While preparing the given methodology the following documents have been used and analysed: documents of the RoK, World Bank and European Commission documents relating to Environmental Assessment and Environmental Impact Assessment; Report on Social and Health Assessment for Kashagan Experimental Programme (ADL Company in association with Synergy, October 17, 2003); the Social Sphere Impact Assessment Guidance (Shell Company, February 28, 2003), Integrated Impact Assessment Guidance (Shell Company, December 2002) and Health Impact Assessment Guidance (December, 2002).

– **METHODOLOGICAL CHARACTERISTICS OF SOCIO-ECONOMIC IMPACT ASSESSMENT SECTION DEVELOPMENT**

Impact assessment is the forecast of potential anticipated social and economic consequences resulting from the ongoing or planned activity and their management through project development, as well as mitigation and compensation measures so that any negative consequences can be minimized, whilst enhancing positive impacts.

In this case, the social sphere impact assessment is an instrument for determining and assessing potential impacts of anticipated project on the local communities and the society, as a whole, and jointly with design solutions, for developing appropriate mitigation measures.

– TERMS AND DEFINITIONS

Acceptable risk – risk, the level of which is permissible and substantiated based on socio-economic consideration. The facility operation risk is acceptable, if the society is willing to accept the risk for the sake of benefit from the facility operation.

Consequence - result of planned economic activities' impact and entailed changes reflected in socio-economic, economic and ecological environment.

Direct impacts - the impacts directly associated with operations under implementation in the project area. They include the changes in social parameters such as employment, standard of welfare (incomes), and state of population health.

Emergency risk analysis - process of hazards' identification and emergency risk assessment with respect to industrial facility hazardous for certain persons, groups of people, property or environment.

Emergency risk assessment - process of identifying the probability (or anticipated frequency) and severity of emergency consequences for human health, property and/or environment.

Emergency risks identification - process of analysing sources of emergency risks at hazardous industrial facility, and also characterisation of these risks.

Enhancement – activities undertaken by the Company to maximise all positive social and economic consequences.

Impact - means any consequences of planned activity for an environment, including health, safety, flora, fauna, soil, air, climate, landscape, historical monuments and other material objects or interrelation between these factors; it also includes the consequences for a cultural heritage or for socio-economic conditions being the results of these factors change.

Impacts screening is the process of identifying, revealing, defining the types of the potential impacts from planned activity upon the natural environment or socio-economic sphere.

Indirect impacts - socio-economic impacts that are not directly resulting from project implementation, frequently manifesting themselves at distance from project implementation area or being the result of an identifiable chain of cause and effect from a direct impact of the project. Sometimes the given type of impact can be considered as secondary (side) effect.

Negative impact – negative change in the existing situation as a result of project implementation.

Mitigation - actions to be undertaken by the Company to reduce or eliminate negative impacts.

Positive impact – positive change in the existing situation resulting from project implementation.

Residual impact - the impact remaining after mitigation measures have been applied.

Scoping – process of determining the content and scope of issues for obligatory incorporation into EIA project materials to be subsequently submitted to the competent body for consideration. (*European Commission Guidance on EIA. Scoping; 2001*).

Settlement – part of populated Republican territory formed as a result of economic and other activity of citizens with the numbers of not less than 50 persons.

Social Impact Assessment – a process for determining and assessing potential impacts of the project on local communities and society as a whole, as well as to develop appropriate mitigation measures.

Stakeholders – all the parties likely to be influenced by the project or be interested in it.

– **SOCIO-ECONOMIC IMPACT ASSESSMENT PROCEDURE**

The section «Socio-economic impact assessment» is an obligatory component of the Environmental Impact Assessment.

Socio-economic impact assessment of planned activity is made using the application of available materials and statistical data obtained from:

- The RoK Agency on Statistics and its regional subdivisions;
- Republic and Oblast Sanitary-Epidemiological Stations;
- Republic State Enterprise "Kazhydromet" subdivisions;
- Scientific and Research Organisation Funds;
- The RoK Ministry of Environmental Protection;
- The RoK Agency on Land Resources Management;
- The RoK Ministry of Labour and Social Protection;
- Culture Committee under the Ministry of Culture, Information and Public Accord of the Republic Kazakhstan, Oblast and Municipal Committees on Historical and Cultural Monuments Protection.

– SOCIO-ECONOMIC IMPACT ASSESSMENT OF PLANNED ACTIVITY

a. Socio-Economic Impact Assessment Stages

The generalised step by step scheme for socio-economic impact assessment is shown in Figure 5.1.1.

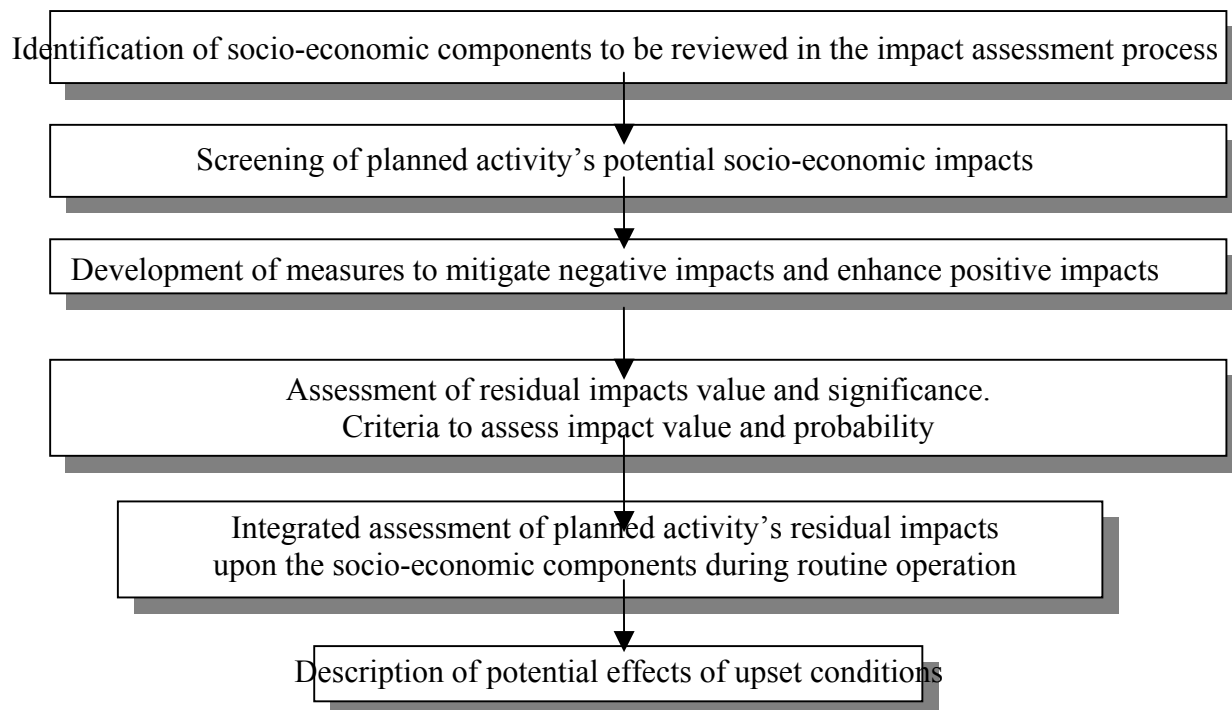


Figure 5.1.1 Step-by-step scheme of impact analysis for socio-economic impact assessment

b. Identification of socio-economic components to be reviewed during impact assessment (Scoping)

The scoping of socio-economic impacts from the project likely to generate impact stakeholders is based on:

- Experience from other projects;
- Project technical description;
- Consultations;
- Baseline data and reports;
- Potential impacts from the history of previous oil and gas exploration in the region.

Social and economic components to be assessed are shown in Table 5.2-1

Table 5.2-1 Socio-economic parameters to be used for impact assessment

Social component	Economic component
Employment	Economic development of area
Population health	Commercial fishing
Education and research and engineering	Commercial navigation
Income and living standard	Land, air, and sea transport
Community relationship and internal migration	Land tenure
Inflation	Agriculture
Recreational resources	Foreign economic activity
Historical and cultural monuments	Investment activity

a. Screening of Planned Activity's Potential Impacts upon the Socio-Economic Sphere

An important initial activity in any EIA is screening. Screening is an open and early activity to identify the impacts that are most likely to be significant or to be of greatest concern to the public and will require investigation during the EIA. This was conducted during the Pre-EIA. The potential direct, indirect and stimulating impacts on socio-economic sphere were identified at the screening stage.

Stimulating impacts are the impacts caused by changes in social sphere that are resulting, in their turn, from economic changes initiated by the project. Such effects may manifest themselves during a longer period as compared with direct and indirect impacts. In some cases stimulating impacts are designated as induced effects.

b. Measures to Mitigate Impacts

Mitigation measures are actions applied to control the impacts – reduction of potential negative impacts or enhancement of positive impacts in favour of the community involved in the project and of the region, oblast and state as a whole.

Mitigation measures are developed for any impacts that are recognised to be significant.

The Company conducting anticipated activity determines the system of necessary measures even at the stage of planning. The hierarchy of mitigation measures includes the following:

- Project designed in such a way as to minimise potential negative consequences from possible impacts;
- Supplementary developments reducing the impact are applied;
- Compensatory measures are applied when other approaches to mitigation are unable to reduce impacts to acceptably low levels.

The system of mitigation measures include the following categories:

- Measures associated with the Company's social commitments under PSA (Production Sharing Agreement);
- Measures that can be implemented by the Company on its own, using available resources;
- Measures that can be implemented by the Company on its own with involvement of contractors' resources, using available joint resources;
- Measures that the Company and its contractors have no direct responsibility for (e.g., inflation signs on the project territory, uncontrollable inflow of migrants in search of jobs, etc.). However, the Company and its contractors can do a lot in this respect using available resources in interacting with other stakeholders (local authorities (Akimats), state agencies and non-governmental organisations).

By structure, the system of mitigation measures can include:

- Production associated measures, related to technological process improvement, aimed at reducing emissions and discharges into the environment (to minimize health-related effects);
- Measures of organisation, regulation and supervision, aimed at preventing impacts not directly associated with the technological process. Basically, the measures under this category are connected with work among the population, local authorities and other outside stakeholders.

5.5. Assessment of Residual Impacts' Significance. Impact Value Criteria. Impact Probability

The impacts remaining after mitigation measures have been applied are called **residual impacts**. The severity of the residual impact are assessed on the basis of:

- Impact consequence;
- Impact probability.

The assessment of possible positive and negative residual impacts is made at the following levels:

- Site (immediate geographic vicinity of the project);

- Local (administrative district or districts closest to the project);
- Oblast;
- Regional;
- National.

Special attention is paid to the site and local levels when assessing the impacts, i.e. territories planned for project implementation and the nearby settlements. Having assessed the impact on population in general, impact on “vulnerable groups” is tracked. This group includes the unemployed, pensioners, low paid workers and non-qualified persons.

In most of assessments of socio-economic components change it is extremely difficult to determine the quantitative value of changes. In this regard the given methodology represents techniques of semi-quantitative assessment that is based on scores, its principles being described below.

The consequence of an impact is assessed for a combination of selected factors that provide a means to concisely characterize the impact, namely: **spatial**, **temporal** and **magnitude**.

For each socio-economic component the methodology assigns impacts on a scale between 0 and 5.

Appropriate criteria have been developed for each socio-economic impact shown in Tables 5.5-1, 5.5-2, and 5.5-3 and are based on the author’s experience on similar projects.

Table 5.5-1 Spatial scale gradations of socio-economic impacts

Scale of spatial impacts	Criterion	Number of points
Zero	No/negligible impact	0
Site	Impact is observed at the project site	1
Local	Impact is observed in nearby settlements	2
Oblast	Impact is observed in the territory of one or several districts	3
Regional	Impact is observed in more than one oblast territory	4
National	Impact is observed in territories of several adjacent oblasts or the Republic as a whole	5

Table 5.5-2 Temporal scale gradations of socio-economic impacts

Scale of temporal impacts	Criterion	Number of points
Zero	No/negligible impact	0
Short-term	Impact is observed less than or equal to 3 months	1
Medium-term	Impact is observed for more than one season (>3 months) up to 1 year	2
Long-term	Impact is observed for a long time (more than year but less than or equal to 3 years). Usually, it covers the period of project construction	3
Prolonged	Impact is observed from 3 to 5 years. Generally corresponds to period of achieving design capacity	4
Permanent	Impact is observed for more than 5 years	5

Table 5.5-3 Magnitude scale gradations of socio-economic impacts

Gradation of Impact magnitude	Criterion	Number of points
Zero	No/negligible impact	0
Minimal	Positive and negative deviations in the socio-economic sphere are effectively within the limits of variability fluctuations existing before the project implementation commencement	1
Very Minor	Positive and negative deviations in the socio-economic sphere may exceed the existing range of conditions of local residential areas	2
Minor	Positive and negative deviations in the socio-economic sphere will likely exceed the existing range of conditions of Oblast level	3
Moderate	Positive and negative deviations in the socio-economic sphere will likely exceed the existing conditions of Regional level	4
Major	Positive and negative deviations in the socio-economic sphere will likely exceed the existing conditions of average-Republic level	5

– INTEGRATED ASSESSMENT OF IMPACT ON CERTAIN SOCIO-ECONOMIC COMPONENTS

The Integrated assessment is a two-step process.

Step 1: in accordance with the impact scale gradations given in tables 5.5.1, 5.5.2 and 5.5.3, the spatial, temporal and impact scores are summed to produce a combined score for each impact identified for the component being considered. Scores may be either positive or negative depending on the impact being considered.

Step 2: the combined positive or negative scores are summed to provide an integrated score for each component under study.

The integrated score allows us to define the total level of impact (**High, Medium, Low**) for a specific component, as is shown below:

Total Score	Total Impact
+ 1 to +5	Low Positive Impact
+6 to +10	Medium Positive Impact
+11 to +15	High Positive Impact
0	No Impact
- 1 to -5	Low Negative Impact
-6 to -10	Medium Negative Impact
-11 to -15	High Negative Impact

An example is provided below for clarity:

Socio-economic component <i>Employment</i>					
Positive Impact – <i>Employment growth</i>			Negative Impact – Frustrated hopes to get a job		
Points			Points		
Spatial	Temporal	Magnitude	Spatial	Temporal	Magnitude
+4	+3	+4	-3	-1	-1
Sum = (+4)+(+3)+(+4)= +11			Sum = (-3)+(-1)+(-1)= -5		
Total Score = (+11) + (-5) = (+6)					
= Medium Positive Impact					

It should be noted that the scores are not intended to represent any particular value associated with an impact. The scoring system is designed to provide a tool for the authors and readers to readily differentiate impacts as to their anticipated overall effect. The impacts can then be "translated" using the above table into a qualitative statement that will assist in comparing impacts over a broad range of dissimilar effects.

– IMPACT ASSESSMENT UNDER EMERGENCY SITUATIONS

Social and economic effects may occur as a result of emergency situations. However, emergency events are unpredictable and the project is designed and will be operated to minimize the potential for emergency situations. Although there is a small probability of a major emergency event occurring during the project lifetime, the most realistic expectation is that emergency events with substantial and far-ranging social and economic effects will not occur in the 40 year project life. Those emergency events that may occur during the life of the project are most likely to be minor and their social and economic consequences will also be minor. Therefore, it is important for readers to understand that any assignment of potential social or economic effects to emergency situations is not a prediction that such effects will occur during the life of the project. It is only a recognition that, if such unlikely events do occur, the potential consequences identified are likely to follow from that event.

Significant social and economic impacts of emergency situations are contingent upon the particular emergency event actually occurring. Since the probabilities of emergency events with substantial social and economic consequences are very low, the probabilities of the associated social and economic impacts are similarly very low. Only in the unlikely circumstance of such an event actually occurring would the social and economic effects identified in the assessment be expected to result.

Therefore, the social and economic consequences of emergency events are considered separately from the consequences of normal operations. Only those significant emergency events where off-site health or economic consequences can be expected to occur if the event occurs are considered. These events are identified in Chapter 6 covering the impacts of abnormal operations where standard risk assessment methodologies are employed to assess the probability and consequence of emergency situations. Where the consequences include potential effects to the public or substantial economic loss or consequent expenditures on the part of the project operator to return facilities to an operational condition, those potential social and economic impacts are discussed in a separate section devoted to abnormal operational consequences.

a. Hazard Identification (Screening) and Risk Assessment

The emergency events on which the social and economic impact assessment is based are derived directly from the Emergency Impact analyses conducted for the project in Chapter 6 of the EIA. The events identified in those analyses, which are likely to have social and economic consequences, are evaluated for their potential effect as described in Section 7.2 below.

It is necessary to emphasise that not all the processes incorporated within the anticipated project activities are evaluated, but only the most hazardous. Most potential emergency events have very low or immeasurable social or economic consequences (e.g., minor gas or oil leak from a pipeline or minor fire at a facility). In order to adequately describe for readers the potential social and economic effects of emergency events, it is therefore not necessary to assign social or economic impacts to all potential emergency events. The identifiable socio-economic consequences of such events are below any reasonable threshold of detectability. Therefore, the analysis focuses only on those events with large physical effects that can reasonably be expected to result in identifiable social or economic consequences.

b. Assessment of Socio-Economic Emergencies' Consequences

Assessment of the social and economic consequences of emergency events necessarily involves a considerable degree of judgement. Although quantitative methods exist for

estimating the probability of emergency situations and assessing the areal extent of physical impacts from emergency events, social and economic consequences do not lend themselves to quantitative assessment. Potential consequences depend on the nature of the event and the resulting effects on project facilities, the local environment, off-site structures, and human health, etc., none of which can be predicted accurately in advance. Therefore, social and economic effects of emergency events are assessed on the same qualitative scale used for the socio-economic impact assessment of construction and operations. However, they are described in a separate section to emphasize that they are contingent upon the occurrence of unlikely events.

Social and economic effects of emergency events are assigned impact scores, but those scores are only valid should the event occur. Therefore, the scores are described in the context of the probability of the event. Probabilities are derived from the Emergency Impact analyses in Chapter 6 of the EIA. Therefore, the analysis presents the scores as determined by the method described above for operational impacts, with the added context of the probability of the event occurring during one year and for the total anticipated 40 year duration of the project.

c. Preventing and Mitigating Emergencies' Consequences

Project facilities and operational procedures are designed specifically to minimize the occurrence of emergency events and to reduce the consequences of events that do occur. Corporate Plans and Procedures provide information on the following:

- Emergencies prevention;
- Minimising emergencies' scope;
- Mitigation of emergencies' consequences to the acceptable risk level, including additional measures to improve efficiency of control (engineering and managerial measures, centralised control).

CONCLUSION

- The above methodological approach describes the structure and procedure for the “Socio-economic impact assessment of planned activity” section for construction, routine operation, and emergency situations.
- The methodology for socio-economic impact assessment is based on the following three impact parameters:
- Spatial scale;
- Temporal scale;
- Impact magnitude.

Each of the impact scales is scored from zero to 5 points. The appropriate criteria have been developed for gradation and are included in the tables summarizing the impacts.

- The given methodology has been developed with reference to the regulatory base in force in the Republic of Kazakhstan and appropriate international reference documents.

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