

**Regulations on exploration and production of (unconventional) hydrocarbons
in the framework of environment protection and monitoring**



ІГНД

**УКРАЇНСЬКИЙ
ІНСТИТУТ ГАЗУ
НЕТРАДИЦІЙНИХ
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The research report has been prepared by "KT-Energia" in the framework of "Ukrainian Unconventional Gas Institute" project being executed by "Shell Exploration and Production Ukraine Investments (IV) B.V." and British Council.

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About research

The research report has been prepared by "KT-Energia" in the framework of "Ukrainian Unconventional Gas Institute" project, being executed by "Shell Exploration and Production Ukraine Investments (IV) B.V." and British Council.

Ukrainian Unconventional Gas Institute project is aimed at promoting unconventional gas exploration and production in Ukraine, increasing awareness and economic, environmental and social studies related to industry impact on local, regional and state development.

International energy and petroleum company group Shell has started its activity in Ukraine in 1992. As of the current moment Shell performs its activities in hydrocarbon exploration and production, natural gas supply, fuel and lubricants marketing and gas station network operations. The Company is involved in two exploration and appraisal unconventional gas projects in Ukraine. Detailed information is provided at www.shell.ua.

"KT-Energia" LLC provides consulting services in energy industry and environment impact of economic activity. The Company has established and maintains on-line Ukrainian unconventional gas resource – www.shalegas.in.ua. "Unconventional Gas in Ukraine" project highlights technical, economic, environmental and other issues of unconventional hydrocarbons, including shale and tight sandstones gas, deep water off-shore gas, coal beds' methane and others. Detailed information is provided at www.kt-energy.com.ua.

Legislation of Ukraine related to environmental protection and monitoring at (unconventional) hydrocarbon production, acting as of the beginning of October 2014, has been analyzed in the report. It reviews the project issues of environment impact assessment and environmental expert review, permitting procedures in environment protection sphere, limitations imposed on well placing, requirements on surface and ground waters' and water sources' protection, waste management and others.

Introduction

Unconventional hydrocarbon production (shale gas, tight sands gas, etc.) is a new activity for Ukraine. On one hand it is related to potential energy independence and on the other - to environmental risks. Thus, it is important to establish on a state level regulatory mechanisms which would minimize anthropogenic environmental impact during unconventional hydrocarbon production.

More than 100 legal acts have been analyzed herein. They regulate the project issues of environment impact assessment and environmental expert review, permitting procedures in environment protection sphere, limitations imposed on well placement, requirements on surface and ground waters' and water sources' protection, waste and waste water management, radiation monitoring, soil reclamation and others. In spite of absence in Ukrainian legislation of specific requirements on project issues in unconventional hydrocarbon production, hydrofracturing technology and horizontal drilling are absent, environmental protection and monitoring issues are quite well regulated by legal documents setting forth the rules of conventional natural gas and oil production as well as rules for other economic activities.

At the same time there is a need to further Ukrainian legislation improvement. The key steps on reforming the regulatory base on environmental protection and monitoring at unconventional hydrocarbon production shall be aimed at consideration of peculiarities of such technologies as hydrofracturing and horizontal drilling, simplification of bureaucratic permitting procedures and improvement of transparency and information access.

Hydrofracturing and horizontal drilling technology which are being widely used to produce unconventional natural gas and oil are related to additional environmental impacts and risks (higher water consumption rates, use of larger chemical amounts, higher risks of surface and groundwater contamination, etc.) Taking into account international experience it is difficult to regulate, among other, the issues of basic environment condition assessment on the areas of unconventional production (subject and procedure of survey, survey area, etc.), access process in reference with information on chemical substances used for hydrofracturing, issues of state regulation of hydrofracturing technology application in water protection areas. Regulating the above mentioned peculiarities of unconventional production shall be performed taking into account "Recommendations on fundamental principles at execution of hydrocarbon production projects, namely shale gas production and hydrofracturing technology". These are approved by European Commission.

Permitting procedure in environment protection sphere in Ukraine is complicated and long (see Appendix 1). Different authorities involved in issuing various permitting documents and the need to obtain a number of approvals from economic entities prior to applications and claims are submitted create bureaucratic obstacles and cause delays in project implementation at hydrocarbon (unconventionals) production. Certain steps for deregulating were made when in spring 2014 a number of amendments to legal acts were adopted and responsibility to get approvals and conclusions has been transferred to permitting authorities. However in order to practically implement the specified norm a number of laws and regulations shall be adopted. Unification of procedures and providing for the option of submitting all applications and claims to permitting regional centers of state administrations will simplify and facilitate unconventional gas production projects' execution. Contradictions which exist in different laws and regulations

will also require elimination. Those are mainly the need of State environmental expert review of design documents (see Section 1) and the need to obtain a permit for hazardous wastes disposal (see Section 2), etc.

Finally, it is very important to provide transparent information on unconventional's production projects and openly involve population into decision making process during project execution. It is very important, on this path, to introduce requirements on mandatory free access publications, in the Internet and on special web-sites, letters of intent related to project execution, reports on project environmental impact assessment, establishment of open registers of environmental permitting documents and publicizing data on substances being used during hydrofracturing.

1. Requirements on environmental impact assessment and environmental basic studies

Articles of the Law of Ukraine "On Environmental Protection" require (Article 51) adherence to norms of environmental safety of people, reasonable use of natural reserves and compliance with the border values of harmful environmental impacts at design, placement, construction, start-up of new and upgrade of existing facilities, structures and buildings. In reference with the above mentioned it is expected that commercial and other projects shall provide data on project environmental and people's health impact assessment.¹

The Law of Ukraine "On Regulating Civil Construction Activities" (article 31) provides that design documents for construction of facilities of increased environmental hazard as well as facilities subject to cross-border environmental impact assessment shall be supplemented with the results of Environmental Impact Assessment (assessment and public hearings documents and reports) Study².

Activity types of high environmental hazard are:

- mineral reserves production, excluding mineral reserves of local standing produced by land owners and land users on land plots provided for economic and household needs;
- storage, treatment and transporting of hydrocarbon raw materials (natural gas, shale and dissolved gas, CBG, coal beds gas (methane), condensate, oil, oil bitumen and liquefied gas).³

Thus for hydrocarbon production (oil and gas) Environmental Impact Assessment (EIA) is mandatory. Such assessment is done at the design stage and report on Environmental Impact Assessment is a part of design documents.

Contents, composition and procedure of EIA Report are regulated by State Construction Norms SCN A.2.2-1-2003 «Composition and contents of data pertaining to evaluation of environmental impact (EIA) in course of design and construction of enterprises, buildings and facilities".⁴

EIA is aimed at determining feasibility and acceptability of planned activities and justification of economic, technical and organizational, sanitary, state, legal and other measures ensuring environmental safety.

EIA materials are provided as a part of design documents to authorized state bodies for expert review and shall comprehensively describe the results of environmental impact assessment in reference with natural, social, habitability and industrial environments as well as justify acceptability of the planned activities.

¹ The Law of Ukraine "On Environment Protection" <http://zakon1.rada.gov.ua/laws/show/1264-12/>

² Law of Ukraine "On Regulating Civil Construction Activities" <http://zakon2.rada.gov.ua/laws/show/3038-17/print1392114405777519>

³ Decree of the Cabinet of Ministers of Ukraine #808 dated 28.08.2013 "On Approval of the List of Environmentally Hazardous Activities and Facilities" <http://zakon2.rada.gov.ua/laws/show/808-2013-%D0%BF>

⁴ SCN A.2.2-1-2003 "Composition and contents of data pertaining to the evaluation of the environmental impact (EIA) in the course of designing and construction of enterprises, buildings and facilities".

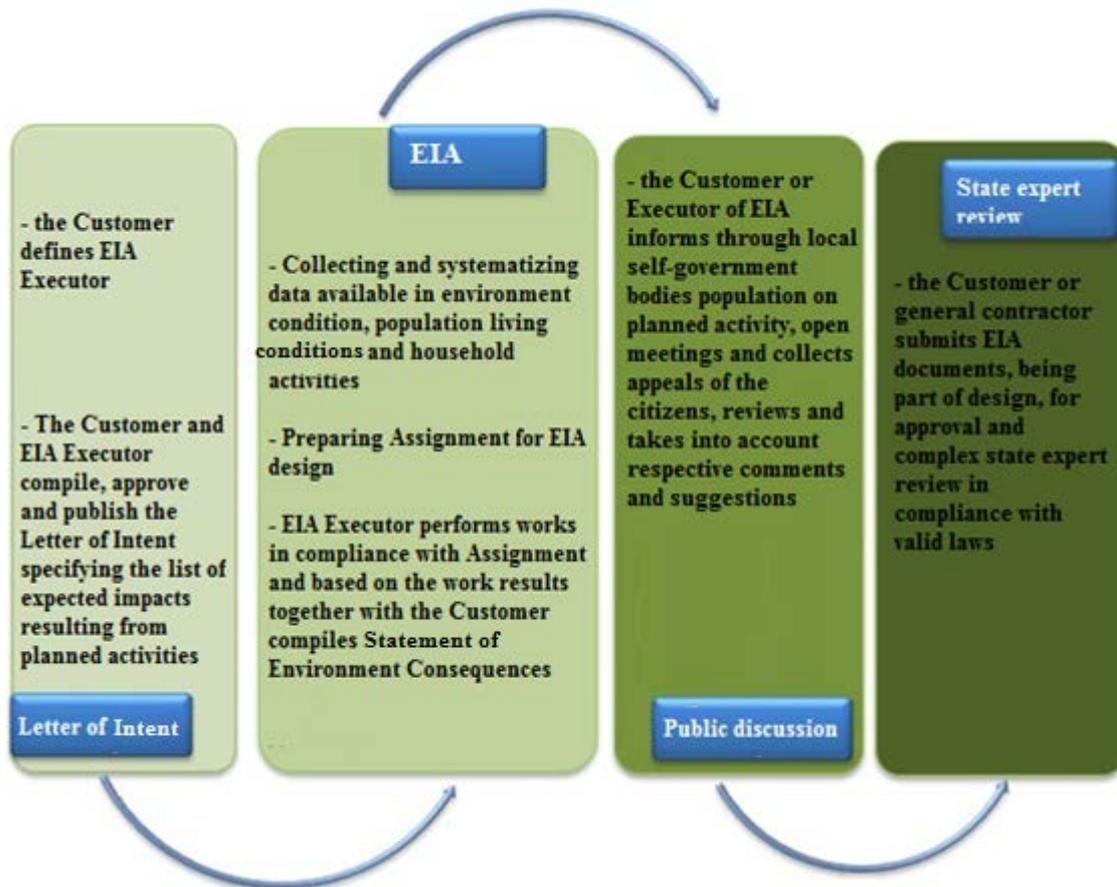


Figure 1. Sequence of EIA Report preparation

Letter of Intent

Letter of Intent is a first step to project environmental impact assessment. In the Letter of Intent an investor declares specific planned activities, provides their main parameters, location, data on resources needed for construction and operations, and provides brief information on its potential environmental impacts.

Besides, in the Letter of Intent information participation of population in the process of decision making in course of project execution is provided along with address, telephone number and time of familiarizing with project materials and EIA Report data.

Letter of Intent is circulated through mass-media.

Environmental Impact Assessment Report

EIA main tasks are:

- general description of current planned work region and site;
- review and assessment of environmental, social and industrial factors, sanitary and epidemiological conditions, competitive and potential alternatives (including process and geographical) of the planned activity and justification of advantages of the selected option and location;
- defining the list of potential environmentally hazardous impacts and impact zones formed by the planned activity;
- defining the scale and level of planned activity environment impact;
- forecast of environment changes as compared to the list of impacts;
- defining the set of measures on prevention or limitation of planned activity's hazardous environmental impacts, needed to adhere to requirements of nature protective and sanitary legislation as well as other laws and regulations in environment protection sphere;

- defining acceptability of expected residual environmental impacts which can be observed after all planned activities are performed;
- preparing Statement of Planned Activity Environmental Consequences.

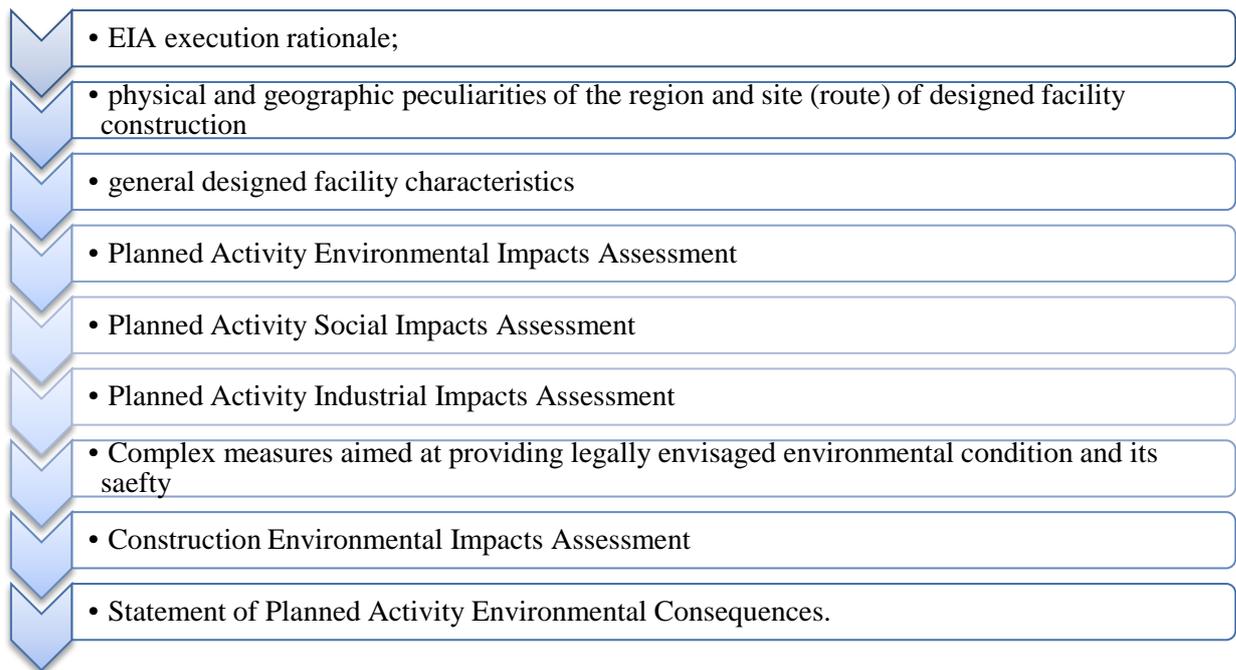


Figure 2. EIA Report structure

In section "***EIA execution rationale***" brief description of potential environmental impact caused by planned activity, public attitude to project, list of limitations imposed, legal documents used, previous approvals and other general information is provided.

Section "***Physical and geographic peculiarities of the region and site (route) of designed facility construction***" shall include brief description of physical and geographic conditions, landscape, natural reserved areas, generalized description of flora and fauna in scope needed for environment, sanitary and epidemiological, social, economic assessment of regional and local level, parameters of all negative impacts distribution in the planned activity impact zone as well as respective maps and layouts, etc.

Brief description of planned activity shall be provided in section "***General designed facility characteristics***" and shall include:

- consideration of planned activity location options (including alternative activity rejection) and options of technological processes if they are described in the design assignment;
- data on construction sites sizes, occupied lands areas;
- brief description of production, its hazard category and type of manufactured products;
- data on raw material, land, water, energy and other resources used;
- description of the planned activities process specifying all environmental impact factors and technical solutions aimed at eliminating or reducing harmful emissions, discharge, leaks, radioactive emissions into environment, as compared to the best domestic and foreign analogs;
- description of engineering networks and communications, harmful substances gathering, cleaning and removal systems;
- design data on estimated amounts of all types of gaseous, liquid and solid operational wastes and utility solid wastes, design solutions on environmental and sanitary safety of wastes disposal or destruction, both on the designed facility and during wastes transfer to other companies for further use and processing;
- assessment of potential origin and development of emergencies;

- list and characteristics of potential environmental impact sources;
- list of potential impact sources and potential borders of impact zones both for construction and operational phase of the planned activity;

Key data on environmental impact of activity is provided in section *"Planned Activity Environmental Impacts Assessment"*

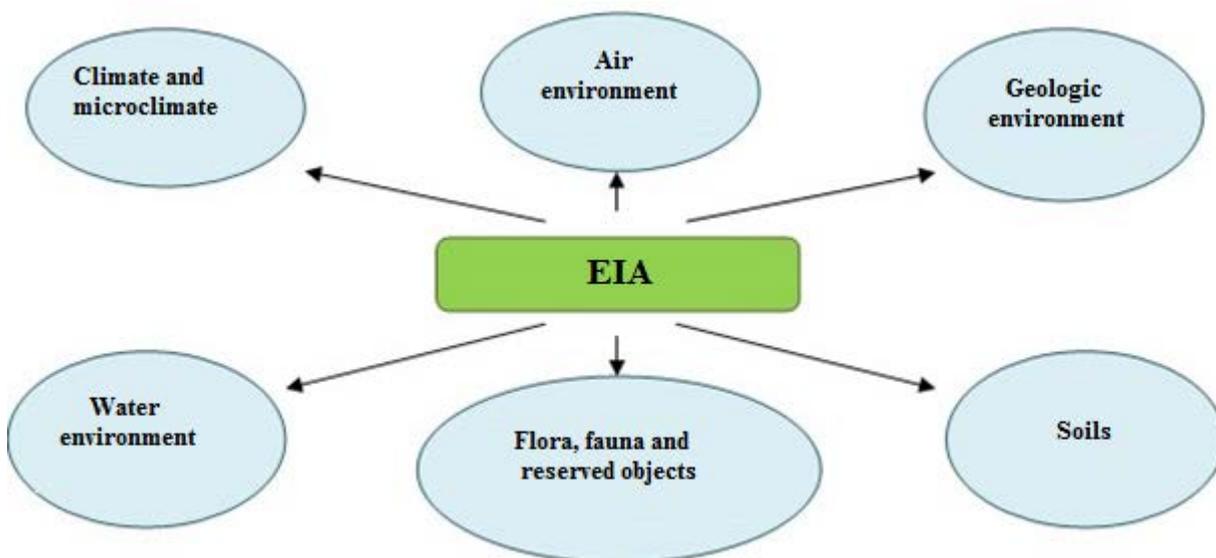


Figure 3. Issues considered at environmental impact assessment

For each environmental component reviewed the following is provided:

- justification of necessity to assess its properties;
- the list of impacts (including indirect) which are differentiated by scale and significance of consequences, their qualitative and quantitative properties and level of hazard;
- justification of borders of the planned activities' zones; data on sanitary protective zones and cuts;
- characteristics of retrospective, modern and expected state of environment, its estimations based on background and normative parameters, description of possible emergencies;
- justification of actions preventing and limiting negative impacts, estimation of their efficiency and residual impacts properties;
- analysis of construction limitations related to planned activities based on environmental conditions;
- scope of engineering needed for area preparation.

Thus in part of the basic analysis of environment state EIA report shall provide summary of retrospective and current state of environmental components which should be analyzed and procedures of such analysis which are not envisaged by Ukrainian Law.

Information of the section *"Climate and micro climate"* shall include:

- summary description of climate zone where the activity is planned;
- main quantitative properties of current and persistent climate data;
- estimation of the expected micro-climate zones in event active and large scale planned activities' impacts (significant inert gases, heat or moisture emissions) are expected;
- estimation of climate conditions impacts in case they are adverse for air contaminants dispersal;
- potential formation of micro-climate conditions which can promote spread of adverse flora and fauna species;
- peculiarities of climate conditions favourable for increase of planned activity environmental impact;

Measures preventing negative climate and micro climate impacts of planned activity or adverse environmental changes related to such impacts shall be carried out as and when necessary.

Information of the section "***Air Environment***" shall include:

- properties of contaminating air emissions sources, their layout scheme, calculation of emission volumes with references to calculation methods applied;
- results of calculation of the surface concentrations with reference to used software;
- data on background ambient air contamination in the area of designed facility location (in-kind data from stationary monitoring points, under plume sites, calculated, etc.);
- estimation of ambient air contamination level formed by the designed facility. Estimation shall account for the background contamination level defined in hygienic norms;
- expected, for the calculated period, background concentrations of the admixtures without accounting for planned activity impacts and expected ambient air contamination level accounting for the expected background values and planned activity impact;
- assessment of the ambient air contamination at adverse atmospheric conditions and respective meteorological and ecologic limitations of the maximum one time emissions;
- assessment of contamination expected during potential emergencies;
- justification of the allowable emission levels and measures aimed at preventing or reducing formed scopes or emission volumes of ambient air contaminants;
- suggestions on determining sizes of sanitary protective zones on the basis of calculations performed for planned activity and air contamination caused;
- monitoring of ambient air condition. Methods and means of its control;

Among other this section provides analysis of noise properties of the planned activity facility:

- data of metering background noise levels in-kind (if such metering has been performed);
- calculated noise levels of the designed facility;
- justification of the noise level reducing measures;
- justification of requirements on the noise protective measures.

The section provides analysis of the heat emissions' impacts, sonic, magnetic and ionizing radiation as well as justification of preventing and mitigating measures.

Section "***Geologic Environment***" provides general description of main components of geologic, structural and tectonic structure, geomorphologic peculiarities and landscape, analysis of existing and expected negative endogenous and exogenous processes, natural and man-made phenomena (tectonic, seismic, geodynamic, shift, torrent, karstic changes, changes of in-situ stress conditions and rock properties, surface deformations and other phenomena) taking into account potential impact of planned activity. This section also provides justification of the measures aimed at preventing or reduction of hazardous geologic processes and phenomena development.

Section "***Water Environment***" provides analysis of hydrology and hydrogeologic changes in water sources' and areas' properties in the zone of planned activity impact. It also provides analysis of priority and specific contaminants impacting surface and groundwater, filling water environment and flowing from sewage or filtration systems.

Analysis results shall provide distribution of assessment parameters of water spaces and sources, in control channels. It shall account for impacts being summed up and justify sanitary allowances, permitted discharge volumes and filtration flows.

Materials describing surface waters provide summarized data on water sources, key data on water intake and household water supply, monitoring points locations. When impacts of planned activity on surface waters and main aquatic organisms are assessed, the following issues are reviewed:

- morphometric, hydrodynamic and water balance parameters;
- water quality, including physical, chemical, sanitary and hygienic, toxicological, parasitological and radiologic properties;

- biologic properties, including type composition, number and biomass, bio-productivity of main aquatic organisms and biologic obstacles for their existence, etc.;

Materials, describing groundwater, shall include general data on the groundwater basin, active water exchange zone capacity, development of groundwater horizons, data on their household use, the list and description of hydrogeologic monitoring points the readings of which are used in EIA report.

Assessment of the planned activity impacts on groundwater is performed for those aquifers which have been actually used as potable, household, medical and other types of water supply. The following is reviewed as the assessment is performed:

- morphometric, hydrodynamic, filtration and water balance parameters;
- water quality, including physical, chemical, sanitary and hygienic, and other properties in compliance with existing laws;
- natural protection conditions.

Data on water quality in aquifers feed zones and water intake areas shall be provided separately.

In this section measures preventing or reducing contaminants content in water environment, disturbance of hydrodynamic regime, depletion of surface and groundwater sources, deterioration of water quality and degradation of aquatic organism shall be provided as well. Calculated options shall include the least favorable periods and potential emergencies.

In section *"Soils"* analysis of the planned activities soil impacts, accounting for land use specifics, availability of precious agricultural lands, chemical, biologic and radioactive contamination, vibration, hazardous engineering and geologic processes and phenomena, as well as other negative factors impacting soil condition shall be provided. In this section measures preventing or reducing negative impacts on soil and deterioration of soil fertility, reclamation activities for soil temporary not used, are also justified.

In section *"Flora and Fauna, Reserved Lands"* a summary of dominating ecosystems, flora and fauna, etc., is provided. In this section measures aimed at preventing or reducing deterioration or degradation of flora and fauna are described. Availability of natural preservation areas and area with preservation potential (reserved for that matter), surface, water or air animal migration ways shall be taken into account. Measures needed to adhere to preserved area regime shall be justified.

In EIA report section *"Complex Measures on Ensuring Required Environmental Condition and Its Safety"* the list and summary of design solutions, including the following, is provided:

- reserves' preserving measures - saving and reasonable use of soil, water, energy, fuel and other resources, their recycling, etc.
- protective measures - protective structures (drainages, screens, curtains, etc.) including process measures (use of environmentally safe and zero waste technology, cleaning, environmentally safe waste management, etc.), planning procedures (functional zoning, arranging sanitary-protective zones, landscaping, etc.) elimination of excessive emissions;
- reclamation activities - technical and biologic reclamation, normalizing condition of specific environmental components, etc.;
- compensations - compensation of irrecoverable loss incurred from planned activity through permanent environment, social and technogenic environment improvement in other places and/or other time, monetary compensation;
- protective measures - monitoring of the areas of planned activity impact, systems of population alert.

In this section limitations imposed on construction facilities based on environmental, social, technogenic and site engineering preparation conditions, needed to adhere to environmental safety criteria, are provided.

Environmental impacts assessment documents shall also include information on wastes produced in course of planned activity, namely:

- designed data on scopes of all types of gaseous, liquid and solid industrial wastes and solid household wastes;
- information on designed process solutions on formed wastes volumes reduction;
- data on wastes disposal directly on the premises;
- data on waste management in case the wastes are transported from the production facility.

In this section of EIA report complex evaluation of the planned activity impacts is performed in regard to environment (on condition the set of measures aimed to provide its required condition based on previous assessments, specified in other sections, is fulfilled). The section also defines the level of environmental risk formed by the planned activity and its impact on human living.

Planned activity risk assessment in regard to natural, social and industrial environments includes:

- analysis of the critical environmental changes and human living conditions;
- analysis of known emergencies and their frequency with breakdown by industrial sphere of the planned activity facilities;
- analysis of the main emergencies' causes;
- analysis of conditions which caused emergencies, including typical options of potential emergencies; assessment of hazardous substances' volumes located in the zone of emergency spread;
- calculation of potential zones of hazardous factors impact on human health, animals and plants, estimation of potential number of victims and loss incurred;
- description of technical solutions on prevention of emergencies and localization of hazardous substances emissions, ensuring fire and explosion safety;
- description of control and automatics, blocking, alarm and other systems aimed at emergencies' preventing.

Conclusions outline the optimality of the proposed designed solutions based on environmental and sanitary laws and ensuring operational reliability of industrial environment facilities. Besides the list and description of the residual impacts is provided; their feasibility at construction and operation of the planned activity facilities is justified.

Based on the results of analysis of the planned activity impact consequences the Statement of Environmental Consequences shall be prepared. **Statement of Environmental Consequences** is a legal document outlining content of these consequences, guarantees of environmental protection measures fulfillment aimed at ensuring environment safety for the whole period of the planned activity. It is prepared by the Customer and General Contractor or, on their request, by the EIA Report Executor. It is a summary of EIA documents and shall include the following:

- description of the planned activity, its purpose and ways of performance;
- significant factors which impact or can impact natural environment condition taking into account possibility of environmental accidents;
- quantitative and qualitative assessment of environmental risks and safety of living, as well as measures ensuring activity performance in compliance with environmental standards and norms;
- list of residual impacts;
- measures taken to inform citizens on planned activity, its purpose and ways of performance;
- Customer's liabilities on fulfillment of designed solutions in compliance with norms and regulations on environmental protection and requirements of environmental safety at all stages of construction and operations of the planned activity facilities.

Statement of Environmental Consequences text shall be published in the mass-media.

Final EIA Report, taking into account public interests, being a part of designed document, shall be submitted by the Customer or General Contractor for approval to State Expert Review authorities.

Public hearings

The Law of Ukraine "On Environment Protection" envisages that every citizen of Ukraine has the right to participate in discussion and make suggestions on the subject of placement, construction and upgrade of facilities which may negatively impact natural environment condition⁵.

To account for public interests during EIA hearings the planned activity Customer shall ensure:

- citizens are respectively informed on planned activity discussions;
- public discussion is arranged;
- design documents are provided to public representatives in compliance with the Letter of Intent.

In compliance with the Procedure on public hearings and discussion of proposed resolutions which may impact environment condition, public hearings shall ensure the following is performed⁶:

- citizens are informed on the beginning of resolution draft review and have an opportunity to participate in discussion;
- public access to resolution draft and documents being a basis for such resolution as well as other necessary information;
- citizens have an opportunity to submit their suggestions (comments) to be taken into account as the resolution is made, to participate in public hearings and other forms of public discussions;
- submitted suggestions (comments) are reviewed;
- citizens are informed on accepting or rejecting submitted suggestions (comments) and the substantiation of such actions are stated;
- citizens are familiarized with resolutions made.

Preparation and submission of suggestions (comments) and public hearings are deemed the main forms of public discussions. Public hearings are mandatory in event the resolution is being made in reference with facilities or activities of high environmental hazard, or other cases envisaged by current law.

Public hearings notification shall be regularly published in mass media or publicized otherwise in such a way that will ensure citizens of respective administrative region are familiarized with it.

Public hearings start with a report made by the Customer on a resolution draft, including data as follows: content of the resolution draft and other documents which are subject to discussion, justification of the resolution necessity; potential negative environmental impact of resolution in case it is implemented and measures aimed at such impact mitigation and/or reduction.

Public discussion facilitator provides answers to public questions verbally in course of public hearings or in writing after they are finished. Results of public hearings and submitted suggestions (comments) are recorded in Protocol signed by Chairman and Secretary elected in course of the public hearings by all participants. In event there are no suggestions (comments) or in event of non-attendance of public hearings by citizens respective Statement is prepared.

⁵ The Law of Ukraine "On Environment Protection" <http://zakon1.rada.gov.ua/laws/show/1264-12/>

⁶ Decree of the Cabinet of Ministers of Ukraine # 771 dated 29.06.2011 "On approval of the Procedure on Public Hearings and Adopting Resolutions which May Impact Environment Condition" <http://zakon2.rada.gov.ua/laws/show/771-2011-%D0%BF>



Figure 4. Public hearings in village of Vesele (Kharkiv region). Photo: Shell Company

According to the results of public discussions their Facilitator prepares all materials, including documents which confirm the fact of publicizing through mass-media and press walls data on discussions arrangement, sending out personal notifications, etc. The documents shall also include the list of suggestions (comments) which were received and data on acceptance, or reasons for rejecting (including partial). In case there were no suggestions (comments) received the act of suggestions absence shall be compiled.

Public discussions for the resolution on assessment of environmental impact done by the planned activity and environmentally hazardous facilities' operations have their peculiarities.

At the stage of preparation of the materials on assessment of environmental impact done by the planned activity and environmentally hazardous facilities' operations, public discussions shall start at the date when the Environmental Consequences Statement has been published. Duration of the public discussion shall not be less than 30 days starting from the date when the State Environmental Expert Review notification has been published. Public discussions are held within 15 days from the date citizens have received the package of documents including justification of the Environmental Impact Assessment.

During public discussions their Facilitator and authority approving conclusions of the State Environmental Expert Review shall ensure no-charge public access to respective data (except for restricted). Such data shall include: package of documents which include justification of the environmental impact assessment; data on significant factors impacting or potentially impacting environmental conditions, accounting for potential environmental accident; data on measures developed to prevent negative environmental impact and/or reduce it; free-access summary of resolution draft being discussed; alternative resolutions' drafts reviewed by the Customer; resolutions made based in the results of public expert review (in event it has been performed).

Information on the resolution made is placed in printed mass-media distributed on the specified territory and on the official web-site of the Facilitator of public discussions.

Documents on public interest consideration shall include:

- data on publishing in the mass-media of the Letter of Intent and Holding of the public discussions;

- written and other documents constituting public appeals;
- list of materials provided from the Customer and EIA Executor for local citizens and public organizations review, list of questions and comments provided by citizens and justified replies;
- generalized resolution on considered public suggestions and justifications related to rejected ones;
- public expert review (if such has been performed) resolution.

EIA Report correction, based on the results of public discussions, is done based on the Customer's and General Designer's decision. Reasons for rejecting either of the resolutions, if needed, are provided to citizens interested.

Environmental Expert Review

State Environmental Expert Review shall be performed in compliance with the Law of Ukraine "On Environmental Expert Review"⁷.

State Environmental Expert Review shall be mandatory for those activities and facilities which are deemed environmentally hazardous. Oil and natural gas production, as it has been already stated, are classified as such.

At the same time, in 2011 the Law of Ukraine "On the Regulation of Urban Planning Activities"⁸ has excluded from the facilities, subject to environmental expert review (Article 7 of the Law of Ukraine «On Environmental Expert Review») the "preliminary design and project documents", and from facilities subject to state environmental expert review (Article 14 of the Law of Ukraine «On Environmental Expert Review») - "investment projects, technical and economic justifications and calculations, preliminary and detailed design documents for construction, extension, upgrade and modernization of operating facilities". Thus, design documents are not considered a State Environmental Expert Review object in the current edition of the Law.

In compliance with the current edition of the Law of Ukraine "On Environmental Expert Review" state environmental expert review is arranged and performed by environmental expert departments, specialized authorities, bodies of regional state administrations involving other executive power authorities and expert review of construction designs is performed under Article 31 of the Law of Ukraine "On the Regulation of Urban Planning Activities".

The Law of Ukraine "On the Regulation of Urban Planning Activities" sets forth the design documents approval and mandatory expert review procedure on the subject of adherence to norms of sanitary and epidemiological welfare of population, adherence to environmental, labour protection, energy saving, fire safety, industrial, radiation and nuclear safety issues, issues of strength, reliability and durability of buildings and structures, their operational safety and engineering support for IV and V complexity class construction objects.

Environmentally hazardous objects shall be classified and class V complexity facilities in compliance with Procedure of Ranging Construction Facilities in IV and V Complexity Class⁹.

Expert review of construction objects is performed by the expert authorities irrespective of the ownership form corresponding to criteria defined by the central executive body implementing state policy of urban construction (Ministry of Regional Development, Construction and Housing). At the same time experts in sanitary and epidemiological welfare of population, environment, labour protection, energy efficiency, fire, industrial, nuclear and radiation safety,

⁷ Law of Ukraine "On Environmental Expert Review" <http://zakon2.rada.gov.ua/laws/show/45/95-%D0%B2%D1%80>

⁸ Law of Ukraine "On the Regulation of Urban Planning Activities" <http://zakon2.rada.gov.ua/laws/show/3038-17/print1392114405777519>

⁹ National Standard of Ukraine "Defining Consequences (Responsibilities) Class and Complexity Category of Constructed Facilities" DSTU-N B V.1.2-16:2013 http://www.minregion.gov.ua/attachments/files/bydivnitstvo/tehnichne-regulyvannya/normuvannya/DSTU_viznachenja_klasu_naslidkiv.pdf and Decree of the Cabinet of Ministers of Ukraine №557 dated 27.04.2011 «On Approval of the Procedure of Ranging Construction Facilities in IV and V Complexity Class" <http://zakon0.rada.gov.ua/laws/show/557-2011-%D0%BF>

who passed professional certification performed with participation of respective central executive power bodies and obtained respective qualification certificate can be involved into expert review (including on the basis of civil law contracts).

Expert authorities based on the results of the expert review performed sends to Customer the written report which, among other, includes information on sanitary and epidemiological welfare of population, environment, labour protection, energy saving efficiency, fire, industrial, nuclear and radiation safety. Expert review duration for objects, subject to environmental impact assessment, shall not exceed 90 calendar days. Expert review agency in compliance with the law is deemed liable for proper quality of expert review performed. Expert review is a final stage of construction design preparation and positive conclusion is deemed a basis for construction works start permit issuance.¹⁰

Thus there is certain contradiction between provisions of the legal acts on state environmental expert review performed for environmentally hazardous projects. On one hand a requirement of such expert review is set forth in the law of Ukraine "On Environmental Expert Review" and on the other hand the Law of Ukraine "On the Regulation of Urban Planning Activities" sets forth the approval procedure for design documents excluding the need of state environmental expert review performed by environment protection authorities.

Below the detailed procedure, of state environmental expert review outlined in the Law of Ukraine "On Environmental Expert Review" is provided.

The purpose of environmental safety review is to prevent negative impact of industrial activity on environment and people's health as well as to evaluate the level of environmental hazard of economic activity and environmental situation on certain territories and facilities.

The main tasks of environmental expert review are:

1. to define the level of environmental risk and safety of planned or performed activity;
2. to arrange complex, scientifically justified assessment of environmental expert review objects;
3. to define correspondence of the reviewed facilities to environmental law requirements;
4. to assess environmental impact of operational facilities passing environmental expert review and their influence on natural resources quality;
5. to assess efficiency, fullness, substantiation and sufficiency of environmental protective measures;
6. to prepare objective, integrated and justified conclusions of environmental expert review.

Conclusions of State Environmental Expert Review are issued solely in permitting centers of territorial branches of the authorized executive and environment protective body.¹¹ Permitting centers are an integrated part of administrative service centers which are formed in compliance with the Law of Ukraine "On Administrative Services".¹²

State Environmental Expert Review is arranged and performed by environmental expert departments and specialized bodies, branches of regional state administrations, jointly with other executive authorities. Central executive authority implementing state environmental protection policy performs state environmental expert review for objects which are being approved (authorized) by the Cabinet of Ministers of Ukraine. Specialists of other agencies, organizations and companies as well as international organizations' experts can be engaged in state environmental expert review.

¹⁰ Decree of the Cabinet of Ministers of Ukraine №560 dated 11.05.2011 «On Approval of the Procedure on Approval of Construction Design Documents and their Expert Review, Deforcement of Certain Decrees of the Cabinet of Ministers of Ukraine" <http://zakon4.rada.gov.ua/laws/show/560-2011-%D0%BF>

¹¹ Decree of the Cabinet of Ministers of Ukraine # 526 dated 21.05.2009 «On Measures on Regulating Permitting Issuance in Economic Activities" <http://zakon2.rada.gov.ua/laws/show/526-2009-п/>

¹² Law of Ukraine "On Permitting System in Economic Activity" <http://zakon1.rada.gov.ua/laws/show/2806-15/>

Persons, who submit documents for environmental expert review, if needed, arrange and fund additional survey, appraisal or expert work, ensure publicity and consideration of public interests on the subject of the planned or performed work, guarantee reliability of preliminary environmental impact assessment provided in the Statement of Environmental Consequences.

Environmental expert review procedure provides for the following:

- check of availability and completeness of needed materials and reference details for environmental expert review objects and forming of environment expert commissions (groups) in compliance with the legal requirements (preparatory stage);
- analytical processing of environmental expert review documents and, if necessary, performing in-kind inspection and, based on the results, comparative analysis and partial evaluation of environmental hazard level, sufficiency and efficiency of justifications provided for environmental expert review objects (main stage);
- generalizing of specific expert analysis of information obtained and expert objects operation, preparing environmental expert review conclusions and submitting such conclusions to authorities and persons interested (final stage).

In order to start state environmental expert review explanatory note to design, project passport (summary) (if it has been prepared together with design documents) and section of environmental impacts assessment shall be submitted together with all needed approvals issued by interested persons¹³.

Documents submitted for state environmental expert review shall be approved by the persons interested, namely:

- Ministry of Health or its local branches (conclusion of state sanitary hygienic expert review)¹⁴;
- Derzhnaglyadokhoronypratsi (State Labour Protection Supervisory Body) or its local branches (expert conclusion on compliance with labour protection legal acts);
- State Fire Safety Board of the Ministry of Emergencies or its local branches (expert conclusion on compliance with fire safety legal acts);

Environmental expert departments dependent on specifics of certain objects of state environmental expert review, may demand submitting expert conclusions of the other interested Ministries, bodies, organizations, agencies or companies (namely, State Mining Control and Industrial Safety Service of Ukraine, State Service of Emergencies of Ukraine, Research Institutes, etc.) as well as other approvals issued by respective executive authorities and local self-government bodies.

At the same time in April 2014 legislative amendments aimed at deregulating economic activities, were adopted. According to those amendments approvals, conclusions and other documents needed to obtain a permitting document, are issued by permitting authority preparing a permitting document, without involving an economic subject.¹⁵ Thus, after respective legal acts were adopted responsibility on approving documents submitted for environmental expert review can be transferred to permitting authority.

Customers of the state environmental expert review shall prepare the Statement of Environmental Consequences for activities as well as documents it is based on.

Statement of Environmental Consequences for activities shall contain data on: a) planned activity, its purpose and ways of implementation; b) considerable factors which impact or may impact environmental condition taking into account potential emergencies and environmental accidents; c) quantitative and qualitative parameters of environmental risks stipulated by

¹³ Decree of the Cabinet of Ministers of Ukraine # 870 dated 31.10.1995 (as amended) "On Procedure of Submitting Documents for State Environmental Expert Review" <http://zakon2.rada.gov.ua/laws/show/870-95-%D0%BF>

¹⁴ Order of the Ministry of Health N 247 dated 09.10.2000 «On Approval of Temporal State Sanitary and Hygienic Expert Review Procedure" <http://zakon4.rada.gov.ua/laws/show/z0004-01>

¹⁵The Law of Ukraine "On amending some legislative acts of Ukraine and reducing the number of permitting documents" <http://zakon2.rada.gov.ua/laws/show/1193-18/page>

planned activity, as well as measures which will ensure work performance in compliance with environmental standards and norms; d) informing population on planned activity, its purpose and ways of implementation.

Terms of state environmental expert review are:

- 1) if performed by environment expert departments, agencies or organizations subordinate to central executive authority implementing state environment protection policy, regional state administrations - up to 45 calendar days with extension up to 60 days if needed. In exceptional cases dependent on complexity the term could be extended to 120 days;
- 2) if performed by specially established organizations - up to 90 calendar days;
- 3) if performed for documents corrected in compliance with conclusions of previously performed environmental expert review - up to 30 calendar days.

Conclusions of the state environmental expert review shall include assessment of environmental acceptability and possibility of making a resolution in reference to the object of environmental expert review accounting for social and economic consequences.

Either execution of projects and programs or carrying out activities without positive environmental expert review conclusions is prohibited. In case negative conclusion is issued for the object of the state environmental expert review the Customer is liable to ensure projects and plans are corrected in compliance with the requirements of environmental expert review conclusion and timely provide documents for additional state environmental expert review.

Positive state environmental expert review conclusion is valid within three years from the date it has been issued. In case implementation of the resolution for the object of state environmental expert review has not been started within the specified period, it is subject to new state environmental expert review.

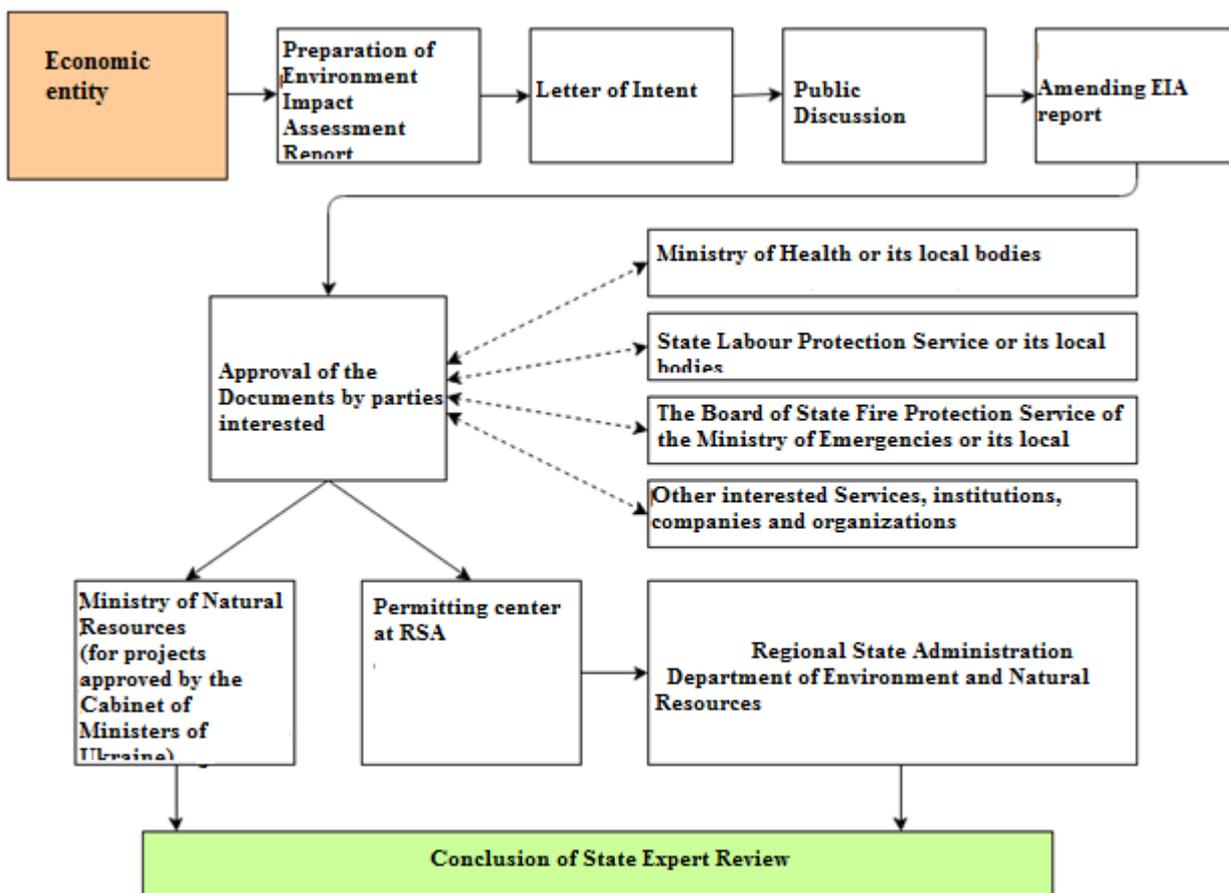


Figure 5. Schematic of obtaining state environmental expert review conclusion

Conclusions of environmental expert review include introduction (protocol), descriptive (summary) and final (estimation and generalizing) parts. Introduction specifies data on authority

which carried out environmental expert review, experts participating, duration of expert review, name of environmental expert review object, its quantitative and qualitative characteristics, information on its customers and executors, as well as on authority making resolution on implementation of the expert review object. Summarized parameters of the planned or performed activity, its environmental impact, level of environmental risks of certain measures aimed at neutralizing and preventing such impact, ensuring adherence to norms of environmental safety, environmental protection and reasonable use and restoration of natural resources are provided in the descriptive part. Generalized assessment of the environmental expert review object, comments and proposals of improvement of environmental impact justification, conclusions on approval, additional processing or rejection of further expert review with a reference to respective legal documents, as well as the reference to potential approval of expert review object in future shall be provided in the final part.

Preparation of environmental expert review conclusions and making resolutions on further implementation (use, application, operations, etc.) of environmental review object is performed with consideration of the public opinion.

Conclusions of state environmental expert review are mandatory for fulfillment. Taking into account resolution on further implementation of expert review objects, conclusions of the state environmental expert review shall be considered equally with conclusions of other types of state expertise.

Environmental expert review agencies or bodies after the expert review is finished publicize conclusions through mass-media.

Except for state expert review, if initiated by public organizations or other non-governmental bodies, public environmental expert review can be performed. Public environmental expert review conclusions are deemed recommendations and may be considered during state environmental expert review as well as at making decision on further implementation of the expert review object.

2. Well location limitations

Ukrainian laws set forth limitations on land plots use and placing industrial facilities thereon, including those of oil and gas production industry.

Limitations of the land plots' use, among other, can be issued in kind of prohibition to carry out certain activities or, in part of adherence to environment protection requirements, prohibition on certain works' performance.

The Land Code of Ukraine defines the following special zones: protective zones, zones of sanitary protection, sanitary-protective areas and lands of special use regime (for military and state border areas)¹⁶.

Protective zones are formed:

- a) around especially precious natural facilities, cultural heritage objects, hydrometrologic stations, etc. These are aimed at protection of the specified facilities from harmful anthropogenic impacts;
- b) along communication lines, power lines, lands of transport, and areas around industrial facilities. These are aimed to provide normal operational conditions, prevent damage and reduce negative impact on environment and people, adjacent land plots and other natural objects;

Sanitary protection areas are formed around objects where surface or subsurface water supply sources, water take and water treatment facilities, water ducts, recreational and other facilities are located. These are aimed to provide sanitary and epidemiological protection of the mentioned areas. Inside the sanitary protection zone activities which can cause damage to surface or subsurface water supply sources, water take and water treatment facilities, water ducts, recreational and other facilities are prohibited.

Sanitary protective zones are formed around objects which are sources of hazardous substances emissions, odors, high noise level, vibration, sonic and electric-magnetic waves, electric fields, ionizing radiation, etc. These are aimed to separate such areas from residential territory. Inside sanitary protective zone construction of residential facilities, social infrastructure and other buildings of permanent people stay, is prohibited.

Limitations on well location related to buildings and structures

Industrial, agricultural and other facilities which are sources of environmental contamination by chemical, mechanic and biologic substances shall be separated from residential areas through forming sanitary-protective zones in case it is impossible to apply zero waste technology.

The Law of Ukraine "On Oil and Gas" envisages establishing of protective and sanitary-protective zones, their size and procedure of application, defined by current law and design documents approved in compliance with procedure set forth. Such zones are established to provide safety of population residing in the region of oil and gas industry facilities' location¹⁷.

On the outside border of sanitary protective zone adjacent to residential area, concentration and levels of hazardous factors shall not exceed their hygienic norms (border limits, border levels). On the borders of resort and residential zones these limits are 0.8 of the normative value.

Sanitary classification of the companies, production types and facilities, defined in State Sanitary Regulations on Urban Planning and Construction in Residential Areas is the basis for setting sanitary protective zones¹⁸.

For oil and gas industry companies the following sizes of sanitary-protective areas are defined:

¹⁶ The Land Code of Ukraine <http://zakon3.rada.gov.ua/laws/show/2768-14/>

¹⁷ The Law of Ukraine "On Oil and Gas" <http://zakon2.rada.gov.ua/laws/show/2665-14/page2>

¹⁸ Order of the Ministry of Health of Ukraine №173 dated 19.06.96 "On Approval of State Sanitary Regulations on Urban Planning and Construction in Residential Areas" <http://zakon2.rada.gov.ua/laws/show/z0379-96/>

Company type	Sanitary protective zone
Oil production companies, H ₂ S emission levels for which are 0.5-1 t/day, as well producing high levels of fugitive hydrocarbons.	1000 m, class I
Natural gas producing companies with gas treatment facilities and booster compressor stations, located on the company's territory.	1000 m, class I
Parametric, appraisal, exploration and producing gas wells' drilling sites on which diesel engines are applied.	500 m, class II
Oil production companies, H ₂ S emission levels for which are 0.5 t/day, as well producing low levels of fugitive hydrocarbons.	300 m, class III
Parametric, appraisal, exploration and producing gas wells' drilling sites on which electric engines are applied.	300 m, class III
Gas well started into production and tied-in to gas pipelines.	300 m, class III

In case the new, non-studied sanitary and hygienically, production types or processes, which may negatively impact environment or population health, are arranged, the sizes of sanitary-protective zones shall be defined in each individual case separately taking into account data on the environmental impact level obtained on analogical facilities operating in country and abroad as well as accounting for respective calculations data.



Figure 6. Well Bilyaivska 400. Shell Company (sanitary protective zone size is 500 m). Photo from www.shell.ua

The following cannot be located within sanitary protective zone:

- residential buildings with surrounding grounds, dormitories, hotels, guest houses and emergency buildings;
- pre-school institutions, regular schools, medical and phylactic and recreational institutions of general or specific purpose with in-patient departments or detoxification dispensaries;
- sports buildings, gardens, parks, and gardening partnerships;
- protective zones of water supply sources, water take and water distribution facilities.

Use of sanitary protective zones of the companies contaminating environment with highly toxic substances of delayed action (heavy metals' salts, carcinogenic substances, dioxins, radioactive substances, etc.) is prohibited for agricultural crops growing and use for pastures. Use of

sanitary protective zones of the companies which do not produce the above mentioned substances for agricultural purposes shall be approved by territorial bodies of the Ministry of Agriculture and Ministry of Health of Ukraine.

Besides, Safety Regulations of Oil and Gas Production Industry of Ukraine¹⁹ set forth the minimum distances between oil and gas industrial facilities and buildings and structures:

Facilities	Well heads of open-flow and gas lift oil, gas and gas condensate wells	Oil wells heads - injection and equipped with artificial lift systems
Residential buildings, campuses, camps.	300 m	150 m
Public buildings	500 m	250 m
Industrial and agricultural companies	100 m	50 m
Power lines	60 m	30 m
Power stations	100 m	50 m

Limits on well placement stipulated by surface and groundwater sources' locations

In Ukraine there are no direct norms stipulating minimum distances between oil and gas well and a water source.

Water protective zones

In compliance with the Water Code of Ukraine and in order to create favorable regime of water sources, prevent their contamination, littering and exhaust, demolition of aquatic plants and animals, as well as to reduce fluctuations of drain along rivers, seas and lakes, water storages and other water sources, water protective areas are established.

Norms of the Land Code of Ukraine²⁰ envisage that water protective zones are formed in compliance with the land allotment design documents. At the same time the Water Code provisions provide that²¹: "outside borders of water protective zones are defined in compliance with special design documents", and the Decree of the Cabinet of Ministers of Ukraine "On Approval of the Procedure on Defining Size and Borders of Water Protective Zones and Economic Activity Thereon" provides²²: "Size and borders of water protective zone is defined by design documents based on normative and technical documents". Specified discrepancies of legal acts have led to significant number of court claims. If court practices on this issue are analyzed, conclusion can be made as follows: courts consider the norm of the Land Code a special one and thus define the need to establish water protective zones in compliance with the land allotment design documents.

Design documents for water protective zones are prepared upon request of physical and legal entities. Such documents shall be approved with land owners, land users, Ministry of Natural Resources, State Water Agency and regional bodies of State Land Agency. They shall be authorized by respective local executive authorities or executive committees of respective councils.

Water protective zone has inside and outside boundary. Inside water protective zone's boundary corresponds to minimum level of water of the water source. Outside border of the water protection zone is usually bound to existing contours of agricultural lands, ways and forest belts, borders of flood plains, their terraces, benches', beams' and gills' edges and is defined as the

¹⁹ Order of State Committee of Ukraine on Industrial Safety, Labour Protection and Mining Control # 95 dated 06.05.2008 «On Approval of Safety Regulations for Oil and Gas Production Industry in Ukraine" <http://zakon2.rada.gov.ua/laws/show/z0497-08/>

²⁰ The Land Code of Ukraine <http://zakon0.rada.gov.ua/laws/show/2768-14>

²¹ The Water Code of Ukraine <http://zakon2.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80>

²² Decree of the Cabinet of Ministers of Ukraine №486 dated 8.05.1996 "On Approval of the Procedure on Determining Size, Borders and Regime of Water Protective Areas and Regime of Economic Activity in Such Areas" <http://zakon4.rada.gov.ua/laws/show/486-96-%D0%BF>

most remote from the water source line: flooding at maximum overflow of water level once every ten years; destruction of the shore line and meandering; temporal or permanent flooding of lands; erosion on shore hills and presence of highly eroded lands.²³

Executive committees of village, settlements, and town councils shall inform population and all interested parties on resolutions made in regard of water protection areas and shore-land protective belts, as well as on water protection regime existing on the specified territories.

On the area of water protective zone it is prohibited to: 1) use resistant and strong pesticides; 2) arrange cemeteries or animal burial sites, disposal fields or filtration fields; 3) discharge non-treated sewage waters using landscape (gills, hollows, open pits, etc.) and streams.

Control over water protective zones and shore-lands protective belts forming as well as adherence to protective regime of area use is performed by executive committees of village, settlements, town councils and central executive authority implementing state policy of environmental monitoring and control of reasonable use, restoration and protection of natural resources.

Shore-land protective belts are parts of water protective zone. They have certain width and are located along the river, sea or water sources. For these belts economic activity regime is more severe than for other areas of water protective zone.

Shore-land protective belts are arranged along the river banks and around water basins along the water edge (in the rainless period). Their width is:

- for small rivers, streams and runlets, ponds with up to 3 hectares area - 25 m;
- for medium-size rivers, water storages and ponds with more than 3 hectares area - 50 m;
- for large rivers, water storages and lakes - 100 m.

If the steepness of slopes exceeds three degrees the minimum width of the shore-land protective belt is doubled.

Shore-land protective belts are natural protective areas with the limited economic activity regime. On shore-land protective belts located along rivers, around ponds and on islands, any type of construction (except for hydrotechnical, navigational, hydrometric and linear) is prohibited. Arrangement of disposal sites, sites of liquid and solid wastes production storage is also prohibited.

The Water Code of Ukraine²⁴ provides that on lands of water stock (such as lands occupied by water sources, shore-land protective belts with no forests) works on mineral resources production can be performed (except for sand, pebble and gravel mining in the rivers and mountain rivers' beds). Drilling and geologic exploration is also allowed on such areas. Locations and procedures of specified works performance are defined in compliance with the design documents approved by local executive authorities, central executive body implementing state policy of water economy development and central executive authority implementing state policy of geologic exploration and reasonable subsoil use. However, it is worth remembering of prohibition of any types of construction (except for hydrotechnical, navigational, hydrometric and linear) on shore-land protective areas.

Construction of the wells on water protective areas and shore-land protective belts can be performed on condition of environment protection authorities' approval exclusively.²⁵

Sanitary protection zones

²³ Decree of the Cabinet of Ministers of Ukraine №486 dated 8.05.1996 "On Approval of the Procedure on Determining Size, Borders and Regime of Water Protective Areas and Regime of Economic Activity in Such Areas"
<http://zakon4.rada.gov.ua/laws/show/486-96-%D0%BF>

²⁴ The Water Code of Ukraine <http://zakon4.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80/>

²⁵ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

Sanitary protection zones (SPZ) are arranged on water take areas of centralized, medical and recreational water supply.

Sanitary Protection Zones are divided into special regime belts. Depending on the source of water supply (surface, subsurface), level of its protection and risk of microbe and chemical contamination, peculiarities of sanitary, hydrogeologic and hydrologic conditions, as well as nature of contaminants, SPZ borders and their specific belts are defined²⁶.

SPZ borders for water sources are defined in the land design documents. SPZ borders for water sources are defined by local self-government authorities on their territories upon approval with state land resources authorities, bodies of sanitary and epidemiological control, bodies of environment protection, water economy and geology. In case SPZ is located on the territory of two and more regions its borders are defined by the Cabinet of Ministers of Ukraine upon submission of the Ministry of Regional Development and approval of the Ministry of Health, Ministry of Natural Resources, State Land Agency, State Geology and Subsoil Service of Ukraine and respective local self-government bodies.

Surface and groundwater SPZs are included into water protection zones and are divided into three special regime belts:

- the first belt (severe regime) includes the water take area, water-works and water pipelines;
- the second and the third belts (limitation and observation) include areas meant for water supply sources' protection from contamination.

Legally a number of limitations imposed on economic activity in SPZ have been defined.

SPZ Belts	For surface water supply sources the following is prohibited:	For subsurface water supply sources the following is prohibited:
1st belt	<ul style="list-style-type: none"> • discharge of any sewage waters and other types of water use impacting water quality; • presence of unauthorized persons, placing residential and public buildings, construction of pipelines and dredging works as well as other types of construction and installation directly not related to operations, modernization or extension of water-works and networks; 	<ul style="list-style-type: none"> • presence of unauthorized persons, placing residential and industrial buildings, construction of pipelines and dredging works as well as other types of construction and installation directly not related to operations, modernization or extension of water-works and networks; • discharge of any type of sewage waters;
2nd belt	<ul style="list-style-type: none"> • placing fuel and lubricants storages, process water pits, oil and products pipelines constituting chemical contamination hazard; • use of chemical substances without permit of sanitary and epidemiological service; • placing clearing and filtration sites, solid wastes polygons and biologic and sludge basins; • production of sand from the water source, other dredging works not related to construction of operation of the water- 	<ul style="list-style-type: none"> • contamination of the area with production and other wastes; • placing storages of fuel and lubricants, pesticides and mineral fertilizers, basins, sludge pits and other facilities constituting chemical contamination hazard for water supply sources; • placing surface filtration sites; • injecting processed (produced) water back into horizons, subsurface storage of solid wastes and subsoil production;

²⁶ The Decree of Cabinet of Ministers of Ukraine №2024 dated 18.12.1998 (as amended) "On Legal Regime of Sanitary Protection Zones of Water Sources" <http://zakon4.rada.gov.ua/laws/show/2024-98-%D0%BF>

	works;	
3rd belt	<ul style="list-style-type: none"> injection of sewage waters into water sources in case sewage waters do not correspond to sanitary regulations and norms (SanR&N 4630-88 "Surface water protection") and norm of the Water Code of Ukraine. 	<ul style="list-style-type: none"> injecting processed (produced) water back into horizons with the purpose of burial, subsurface storage of solid wastes and subsoil production which may result in aquifer contamination; placing fuel and lubricants storages, process water pits, oil and products pipelines constituting chemical contamination hazard for groundwater;

For subsurface water supply sources the first SPZ belt is arranged not less than 30 m from water take if protected groundwater sources are used (formation water sources with seals covering the whole SPZ area) and not less than 50 m if protection of groundwater sources is insufficient. Borders of the second and the third SPZ belts are defined based on hydrodynamic calculations which account for speed of contaminants spread in groundwater.

Within the third SPZ belt drilling of the new wells and any types of new construction is subject to mandatory approval of local bodies of State Sanitary, Epidemiological and Geologic Services.

For surface water supply sources of the first belt SPZ borders are defined accounting for the following requirements:

- for flowing water sources: not less than 900 meters from water take upstream and not less than 100 meters downstream, not less than 100 meters from the water edge observed in summer-autumn rainless periods on adjacent to water edge shore land; besides, opposite from water take shore and with the river or channel width of less than 100 m - the whole basin and the opposite shore, 50 m from the water edge observed in summer-autumn rainless periods; with the river or channel width of more than 100 m - not less than 100 m of basin belt;
- for not flowing sources (lakes, water storages): not less than 100 m from water take in all directions of the basin and not less than 100 m from the water edge during summer-autumn rainless period on the shore adjacent to water take.

Borders of the second SPZ belt for flowing sources (rivers and channels) and ponds (water storages and lakes) are defined based on natural, climate and hydrologic conditions. Lateral boundaries are determined by the shore lines the width of which depends on the water edge line within summer-autumn rainless period and shall not be less than 500 m on a plain, and 750 m on a sloping and 1000 m on a steep hill. The border of the second SPZ belt for flowing source downstream shall not be less than 250 m from water take.

Borders of the third SPZ belt for surface water supply sources down and upstream shall correspond to the borders of the second belt and lateral boundaries shall correspond to water divides within 3-5 km, including tributaries.²⁷

Though construction within the third SPZ belt is allowed the Law imposes severe limitations and sanitary requirements on placing, design, construction, modernization of companies, buildings and structures which impact surface waters' condition. Such are defined in Sanitary Regulations and Norms on Surface Water Contamination Protection.²⁸

Limitations on well placement related to natural reserved areas

Surface and water areas, natural sites and systems that have special ecologic, scientific, aesthetic or economic value and are meant for preservation of natural variety, gene pool of plants and animals, preservation of overall ecologic balance and background environmental monitoring, are

²⁷ Regulations on Procedure of Design and Functioning of Sanitary Protection Zone of Drinking and Household Water Supply Sources and Pipelines <http://zakon4.rada.gov.ua/laws/show/v2640400-82>

²⁸ "Sanitary Regulations and Norms on Surface Water Contamination Protection SanR&N 4630-88"

excluded from economic activity areas fully or partially. They are declared an area or an object of natural reserved fund of Ukraine²⁹.

Natural reserved fund of Ukraine includes state reserved areas, national parks, nature reserves, natural landmarks, botanic gardens, dendrology and zoology parks, landmark and gardening parks and reserved stows.

On natural-reserved areas any economic and other types of activity contradicting the reserved area purpose, breaking natural development of processes and phenomena or constituting hazardous impact on its natural complexes and objects, are prohibited. Thus, geologic exploration, production of mineral reserves, soil, hydrologic and hydrochemical regimes disturbance, damage of geologic outcrops and application of chemical substance are prohibited.³⁰

To ensure the needed regime of natural reserved complexes and natural reserved areas, prevent negative impact of economic activity on adjacent territories, protective zones are established. In case it is necessary protective zones are arranged on the areas adjacent to specific territories of national parks, regional landmark parks, reserved lands, landmarks, reserved stows, botanic, dendrology and zoological gardens, landmark gardens. Sizes of protective zones are defined in compliance with their purpose based on special landscape survey and type of economic activity performed on adjacent territories.

Regimes of protective zones and reserved land are defined accounting for the type of economic activity performed on adjacent territories and based on environmental impact assessment for these territories. Construction of industrial and other objects, hunting, and development of economic activity which may negatively impact the area and objects of reserved land is prohibited. Such impact assessment is performed based on environmental expert review which is executed in compliance with the procedure defined by the laws of Ukraine.

Regulations which determine the regime of each protective zone and each object of the reserved land are approved by state authorities liable for land allotment decision making. Protective zones and reserved land objects are considered when design documents are prepared.

Several zones are differentiated for biosphere:

- reserved area includes territories aimed to preserve and restore the most precious natural complexes, floral and animal gene pool with minimum level of damages done by industrial factors. Its regime is defined by requirements set forth for natural reserved lands;
- buffer zones include territories separated to prevent negative impact on the reserved land from the side of economic activities carried out on adjacent territories. Its regime is defined by requirements set forth for natural reserved lands;
- anthropogenic landscapes zone includes traditional land, forestry, water use areas, settlement locations, recreational areas and areas where other types of economic activities are performed.

National parks are divided into the following zones:

- reserved zone of national park is aimed to protect and restore the most precious natural complexes. Its regime is defined by requirements set forth for natural reserved lands;
- regulated recreational zone, stationary recreational and economic zones are areas where any type of activity which leads or may lead to environment deterioration and decay or impairment of recreational value of the national park is prohibited.

On the territory of regional landmark parks, taking into account their nature protective, recreational, scientific, medical, historic and cultural and other values as well as peculiarities of natural complexes and objects, zoning is performed in compliance with requirements set forth for natural national parks.

²⁹ The Law of Ukraine "On Environment Protection" <http://zakon1.rada.gov.ua/laws/show/1264-12/>

³⁰ Law of Ukraine «On Natural Reserved Land Stock" <http://zakon2.rada.gov.ua/laws/show/2456-12/>

On the reserved area hunting and activities contradicting objectives and purposes of the reserved area regulations are either limited or prohibited.

On the area of natural landmarks any activity which threatens preservation or leads to deterioration or change of their initial condition is prohibited.

On the area of reserved stows any activities which violate processes occurring in natural complexes are prohibited in compliance with requirements set forth to natural reserved lands.

Thus, oil and gas wells construction is prohibited in reserved parks and on natural protected areas regime of which is defined by requirements set forth for natural reserved territories (reserved biosphere reserved lands and national parks).

Construction of the wells on other natural reserved and recreational areas can be performed on condition of environment protection authorities' approval exclusively. Drilling in sanitary protective and recreational zones shall be pitless and household and utility water supply volumes shall be stored in special tanks, deactivated and transported to local treatment facilities.

Use of forestry land plots for mineral reserves production, construction of the pipelines and drilling works shall be performed exclusively after such plots are allotted in compliance with procedure set forth in the Land Code of Ukraine³¹.

In case the resolution on land allotment is provided, envisaging the cut-over right, the special permit (cut-over ticket) shall be issued in compliance with the procedure set forth. Specified works shall be performed in a way that will not impair fire safety and sanitary condition of forests and conditions of their restoration. Tree cut-over and soil damage outside permitted land plots is prohibited.³²

³¹ Forestry Code of Ukraine <http://zakon2.rada.gov.ua/laws/show/3852-12/>

³² SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

3. Ambient air protection requirements and reduction of greenhouse gases emissions



Natural gas production, including unconventional production, is followed by contaminants' air emissions. Such emissions are formed due to fuel burning in internal combustion engines, diesel generators and transport means as well as due to spills and hydrocarbon gases and other substances leaks from subsoil occurring during well construction and hydrofracturing.

To ensure ambient air contamination protection in the region where drilling is performed the following is expected: installation of grease filters on diesel exhaust pipes, adhering to fire safety requirements; use of leak tight and closed tanks for fuel and lubricants storing, gathering and maximum disposal of associated gas during well testing, use of technical means and processes which prevent oil and gas shows and blow-outs.³³

Activity impact on ambient air is regulated through issuance of emission permits and monitoring, reporting and state supervision system aimed at control over contaminants emissions.

Emissions permit

For oil and gas wells projects it is necessary to obtain emissions permit for contaminants exposed into ambient air from stationary sources.

Permit for contaminants emissions from stationary sources (further in the section herein - the Permit) is an official document which ensures the right of economic entity to operate facilities exhausting contaminating substances or their mixtures into ambient air. Such right is provided on condition that respective norms and border values of emissions as wells as requirements on processes limiting contaminants' emissions are fulfilled within the term defined in the permit issued.

Norms of the border values of contaminants emissions from stationary sources are defined by the Ministry of Natural Resources.³⁴

³³ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

³⁴ The Order of the Ministry of Natural Resources # 309 dated 27.06.2006 "On Approval of the Border Values of Contaminants Emissions from Stationary Sources" <http://zakon4.rada.gov.ua/laws/show/z0912-06>, prepared in compliance with the Decree of the

Permit for contaminants air emissions from stationary sources is issued in permitting centers exclusively.³⁵

The Permit is issued free of charge for the term of not less than five years. It is issued by the Ministry of Natural Resources upon approval of the State Sanitary and Epidemiological Service or by Regional State Administration upon approval of territorial departments of State Sanitary and Epidemiological Service. The Ministry of Natural Resources issues a permit for production facilities or facilities on which process equipment is installed. On such facilities, in compliance with legal requirements, the best available technology and management principles (defined power, metal processing, chemical, wood production and processing, waste management and disposal facilities) shall be applied³⁶. For other facilities, including oil and gas wells drilling, permits are issued by State Regional Administrations through permitting centers.

To obtain a permit an economic entity shall:

- compile an application³⁷;
- prepare documents justifying the volumes of contaminating emissions;
- execute inventory of stationary sources of contaminants' emissions, types and volumes of air emissions produced by stationary sources and dust and gas catchers;
- evaluate impact of contaminating air emissions on ambient air condition inside sanitary protective zone;
- prepare actions plan;
 - achieve defined normative limit emission values for most spread and hazardous contaminating substances; carry out air protective measures in case of industrial and natural emergencies;
 - eliminate causes and consequences of ambient air contamination;
 - finalize activity related to contaminating air emissions and restore operational site to satisfactory condition;
 - prevent excessive, as compared to limit set values, emissions in course of production;
 - control adherence of the normative limit values of air contaminants emissions and permit provisions;
- justify the size of normative sanitary-protective zone, evaluate expenses related to arrangement of such zones;
- evaluate and analyze expenses related to fulfillment of planned measures aimed to prevent ambient air contamination;
- in compliance with the laws prepare information on permit issuance to publicize it among population.

To prepare documents justifying emissions' volumes an entity may involve companies, organizations and institutions which are granted a right by the Ministry of Natural Resources to design such documents.³⁸

Cabinet of Ministers of Ukraine # 1789 dated 28.12.2001 "On Approval of the Procedure on Calculation and Approval of Border Values of Contaminants Emissions from Stationary Sources" <http://zakon4.rada.gov.ua/laws/show/1780-2001-%D0%BF>

³⁵ Decree of the Cabinet of Ministers of Ukraine # 526 dated 21.05.2009 «On Measures on Regulating Permitting Issuance in Economic Activities" <http://zakon2.rada.gov.ua/laws/show/526-2009-п/>

³⁶ The List of provided in Appendix 2 to the Order of the Ministry of Natural Resources # 108 dated 09.03.2006 "On Approval of the Instruction on General Requirements to Documents Justifying Emissions Amounts and Aimed at Obtaining Air Contaminants Emissions from Stationary Sources Permits Issued for Companies, Organizations and Physical Business Entities" <http://zakon2.rada.gov.ua/laws/show/z0341-06/page>

³⁷ The Decree of the Cabinet of Ministers of Ukraine # 1176 dated 07.12.2005 "On Approval of the Application Form for Obtaining Permitting Documents by Economic Entity or its Authorized Person" <http://zakon4.rada.gov.ua/laws/show/1176-2005-%D0%BF>

³⁸ The Decree of the Cabinet of Ministers of Ukraine # 302 dated 13.03.2002 "On Approval of Procedure of Performance and Payment of the Work Related to Issuance of Permit for Air Emissions Produced by Stationary Sources, Accounting of Companies, Institutions, Organizations and Physical Entities which Received such Permits" <http://zakon1.rada.gov.ua/laws/show/302-2002-%D0%BF>

Documents for permit obtaining are prepared in compliance with Instruction, approved by the Ministry of Natural Resources, on general requirements to documents justifying emissions limits preparation.³⁹

Documents, justifying the volumes of emissions are an integral part of the application for emissions permit. Validity period of the documents justifying the volumes of emissions is ten years.

For new stationary emission sources proposal on permit issuance and EIA section of design document which received positive conclusion of state environmental expert review, shall be attached.

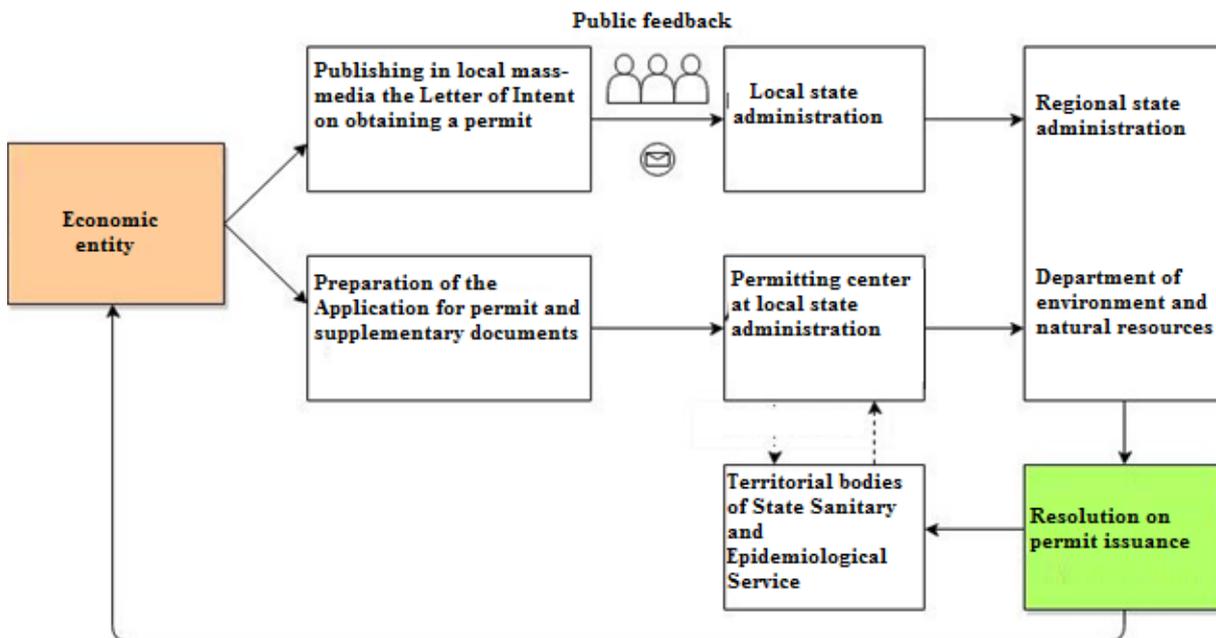


Figure 7. Schematics for obtaining permit on contaminants ambient air emissions

To obtain a permit the economic entity shall submit an application and supporting paper and electronic documents to permitting center of state regional administration. It is also liable to publish in printed mass-media a Letter of Intent to obtain a permit and specify the address of the local state administration to which comments from public organizations and citizens can be sent.

Permitting centers shall provide the application and documents received to territorial bodies of State Sanitary and Epidemiological Service for approval. Territorial bodies of State Sanitary and Epidemiological Service shall within 15 calendar days starting from the date the documents have been received make a resolution on possibility/impossibility to issue permit. Resolution is then sent to permitting centers.

In event the decision of permit issuance impossibility is made comments are provided in the resolution itself.

Local state administrations review comments made by public organizations and in case necessary arrange public discussion of the comments. Within 30 calendar days from the date the Letter of Intent has been published local state administrations shall inform authority issuing the permit on such public discussion arrangement. Authority issuing the permit analyses comments

³⁹ The Order of the Ministry of Natural Resources # 108 dated 09.03.2006 "On Approval of the Instruction on General Requirements to Documents Justifying Emissions Amounts and Aimed at Obtaining Air Contaminants Emissions from Stationary Sources Permits Issued for Companies, Organizations and Physical Business Entities" <http://zakon2.rada.gov.ua/laws/show/z0341-06/page>

and if needed suggests the economic entity to consider those as the permit is prepared for issuance.

Authority issuing the permit within 30 calendar days reviews an application and permitting documents and if there are no comments issues a permit. In case there are comments to documents submitted the latter are returned to economic entity providing the comments and the date of second submission. Permit issuing resolution is sent to economic entity and territorial bodies of State Sanitary and Epidemiological Service.

Monitoring, reporting and state supervision

Monitoring in sphere of ambient air protection is a part of state environmental monitoring system. Arrangement and monitoring procedure in sphere of ambient air protection is set forth by the Cabinet of Minister of Ukraine⁴⁰.

Business entities which carry out activities with contaminating ambient air emissions are liable:

- control the volume and composition of the contamination substances emitted into ambient air and record all the data on continuous basis;
- ensure instrumental and laboratory metering of parameters of contaminating emissions from stationary and portable sources is performed and provide efficiency of gas catching units;
- use metrological certified methods for metering as well as calibrated meters to define concentration of contaminating substances in the ambient air and in emissions.

Implementation of state policy of state supervision (control) of environmental protection and reasonable use, restoration and natural resources' protection is performed by State Environmental Inspection of Ukraine. State Environmental inspection executes state supervision (control) over adherence of the ambient air protection in respect of availability and compliance with all norms set forth for ambient air protection and norms of timely providing full and accurate data in ambient air condition, type and volume of ambient air emissions.⁴¹

Control over contaminating emissions is performed on enterprises which are state registered. To register a facility it is necessary to submit to the territorial bodies of the Ministry of Natural Resources an application, in arbitrary form, general information on facility and data on types and volumes of contaminating substances emitted into ambient air.⁴²

State registration of the facilities is performed if emissions contain at least one contaminating substance (or their group) potential emission (maximum total volume of contaminating substance emission during facility operation in nominal load regime) of which is equal or exceeds the legally defined value.⁴³

On state registered facilities primary accounting documents are kept under the defined form. Primary documents are kept for stationary sources which negatively impact, operations of gas catchers, performance of measures related to reduction of contaminating substances emitted into ambient air.

Forms of initial reporting are:

- Form POD-1 "Log of stationary contaminating sources and their parameters". The log provides the list of all stationary sources of the enterprise and their parameters based on the results of operational emissions control;

⁴⁰ Law of Ukraine "On Ambient Air Protection" <http://zakon2.rada.gov.ua/laws/show/2707-12/>

⁴¹ Decree of the President of Ukraine # 454/2011 dated 13.04.2011 "Regulations on State Environmental Inspection of Ukraine" <http://zakon1.rada.gov.ua/laws/show/454/2011>

⁴² The Order of the Ministry of Natural Resources №177 dated 10.05.2002 "On Approval of the Instructions on Performing State Registration of the Facilities which Negatively Impact of May Impact People's Health and Ambient Air Conditions, Types and Volumes of Contaminating Substances Emitted into Ambient Air" <http://zakon4.rada.gov.ua/laws/show/z0445-02>

⁴³ See Appendix 1 for the List of Contaminating Substances and Border Values of Potential Emissions by which State Registration is performed.

- Form POD-2 "Log of ambient air protection measures carried out". The log provides the measures which are developed in order to reduce the contaminating substances emissions into ambient air;
- Form POD-3 "Log of gas catchers and gas treatment units". It is kept on enterprises where gas catchers are used.

On the basis of the specified documents state statistics reports are provided under special procedure to territorial bodies of State Statistics Service located in the region where stationary emission source is located.

Statistic reports based on volumes of potential contaminating substances' emissions and greenhouse gases are prepared in compliance with the respective forms of state statistic observations on ambient air protection: 2 TP (air) "Report on Ambient Air Protection (annual) and 2 TP (air) "Report on Ambient Air Protection (quarterly).⁴⁴

This statistics form includes data on general contaminating substances and greenhouse gases emissions based on their numbers and codes; information on contaminating substances and greenhouse gases emissions on specific production and process areas, process equipment (units); information on measures carried out to reduce contaminating substances and greenhouse emissions into ambient air. The last section provides names of measures, their estimated and actual cost and expected and actual reduction of contaminating substances and greenhouse gases emissions into the air.

Determining the types and volumes of contaminating substances emitted into ambient air from stationary sources, types and levels of impact on physical and biologic conditions, is performed by direct instrumental metering and calculations approved by the Ministry of Natural Resources using the emission parameters (specific emissions).⁴⁵

Regularity of inspections performed by State Environmental Inspection is determined based on distribution of economic entities by the level of their economic activity risk for environment taking into account environmental situation in the region where inspected facility is located, level and nature of its environmental impact. State Environmental Inspection body not later than 10 days prior to inspection sends a recommended letter or fax, at State Environmental Inspection body's expense, or delivers personally to officials of the economic entity, subject to signature, notification of the planned inspection. Duration of the planned inspection shall not exceed fifteen business days. On the basis of the act compiled upon inspection results and within five days after it has been finalized, the specified body prepares, in case breach of environmental laws have been revealed, an order on elimination of violations of the environmental law requirements. Term of order execution is determined by the State Inspector based on the environmental breaches revealed. Such term shall not exceed 6 months.⁴⁶

Enterprise activities of which are related to mineral resources production and geologic exploration are categorized as high or medium level risk bearing.

Economic entities are categorized as high risk economic entities based on the following criteria:

- 1) availability of facilities which incur high hazard or are potentially hazardous, entities which use hazardous substances of I and II hazard class;
- 2) economic entities which:

⁴⁴ The order of the State Statistics Committee of Ukraine # 396 dated 20.10.2008 "On Approval of the Instruction on Filling-in the form of State Statistic Observations 2 TP (air) "Report on Ambient Air Protection (annual) and 2 TP (air) "Report on Ambient Air Protection (quarterly)<http://zakon2.rada.gov.ua/laws/show/z1075-08>. From 2015 the new edition of the statistic reporting form # 1-wastes will be valid "Waste Production and Management". The form is enforced by the Order of State Statistics Service of Ukraine # 243 dated 19.08.2014 :On Approval of the State Statistic Environmental, Forestry and Hunting Observation Forms" <http://www.vobu.com.ua/ukr/legislations/view/258>

⁴⁵ The Decree of the Cabinet of Ministers of Ukraine # 1655 dated 13.12.2001 "On Approval of the Procedure on State Accounting in Ambient Air Protection Sphere" <http://zakon4.rada.gov.ua/laws/show/1655-2001-%D0%BF>

⁴⁶ The Order of the Ministry of Environmental Protection # 464 dated 10.09.2008 "On Approval of the Procedure on Arrangement and Notification of Economic Entities on Environmental Law Requirements Adherence" <http://zakon2.rada.gov.ua/laws/show/z0018-09>

- a. produce contaminating substances emissions into ambient air in volumes more than 5 thous. tons a year, have water supply and consumption of more than 25 thous. m³ a year or produce and dispose wastes of I and II class of hazard in volume of more than 100 tons a year or produce and dispose other wastes in volume of more than 1 thous. m³ a year;
- b. are related to mineral resources production and geologic exploration including pilot commercial production of mineral resources fields of state standing.

Economic entities are categorized as high risk economic entities based on the following criteria:

- 1) availability of facilities which incur high hazard or are potentially hazardous, entities which use hazardous substances of III and IV hazard class;
- 2) produce contaminating substances emissions into ambient air in volumes of around 5 thous. tons a year, have water supply and consumption of up to 25 thous. m³ a year or produce and dispose wastes of I and II class of hazard in volume of around 100 tons a year or produce and dispose other wastes in volume of around 1 thous. m³ a year;
- 3) are related to geologic exploration.

Planned measures of state supervision (control) on economic entities' activity with high risk levels shall not be performed oftener than once a year and for entities of medium risk level such shall not be oftener than once every two years.⁴⁷

⁴⁷ The Decree of the Cabinet of Ministers of Ukraine # 212 dated 19.03.2008 "On Approval of Criteria of Classification of Economic Entities Based in the Level of Risk of their Economic Activity in Regard to Environment and Regularity of State Supervision (Control) Measures" <http://zakon2.rada.gov.ua/laws/show/212-2008-%D0%BF>

4. Requirements on surface and groundwater sources protection



Protection of water sources during production of unconventional gas is performed through limitation on the oil and gas wells placing (see section 2), regulation of the volume of water resources consumed, through issuance of permits for special water use and by other regulatory requirements aimed at protection of surface and groundwater from contamination (requirements on sewage water management and limitation of contaminated water discharge, requirements on bundling and cementing of the wells, state monitoring and control, etc.).

Permit for special water use

To provide technical water for drilling and completion of the wells water from nearest water sources and streams or from specially drilled water wells, unless there are no other water sources, is used. Use of water from surface and ground sources is performed on the basis of special water use permit.

Special water use permit is issued in the permitting centers exclusively.⁴⁸

In case the water sources of the national standing are used permits are issued by regional state administrations upon appeal of water users. In case the water sources of the local standing are used permits are issued by regional councils upon approval of the regional state administrations.⁴⁹

Water sources of national standing include:

- 1) internal sea waters, territorial seas, basins of the sea ports;
- 2) groundwater which are used as sources of centralized water supply;

⁴⁸ Decree of the Cabinet of Ministers of Ukraine # 526 dated 21.05.2009 «On Measures on Regulating Permitting Issuance in Economic Activities» <http://zakon2.rada.gov.ua/laws/show/526-2009-п/>

⁴⁹The Decree of the Cabinet of Ministers of Ukraine # 321 dated 13.03.2002 "On Approval of the Procedure of Approval and Issuance of Permits for Special Water Use and Amending the Decree of the Cabinet of Ministers of Ukraine dated August 10, 1992. N 459» <http://zakon2.rada.gov.ua/laws/show/321-2002-%D0%BF>

- 3) surface waters (lakes, water storages, rivers and channels) and all their tributaries that are located and used on the territory of more than one region;
- 4) water sources that are located on the natural reserved lands of national standing or considered medical waters.⁵⁰

The list of rivers and water ponds defined as local standing sources is approved by the State Water Economy Committee of Ukraine.⁵¹

Approval and issuance of special water use permits in case water sources of local standing are used shall be performed in compliance with procedures approved by the resolutions of respective regional councils.

On April 9, 2014 the Law of Ukraine "On Amending Some Laws of Ukraine on Reduction of the Number of Permitting Documents" has been adopted.⁵² It has been enforced on April 26, 2014. In compliance with the specified Law the procedure of special water use permit obtaining has been simplified.⁵³ Namely, the specified Law eliminated for the water user the need to get approval for special water use issuance from local water economy, health protection and geology bodies. This responsibility has been transferred to authorities accepting applications from the water users.

Authorities who accept applications of the water users shall within five calendar days from the date the application has been submitted, send the verified copies of respective documents to State Water Resources Agency of Ukraine for approval in case the permit is issued for surface water. The documents are sent to State Geologic and Subsoil Service in case the permit is issued for groundwater. Conclusions of these authorities on possibility of permit issuance shall be provided within fifteen calendar days from the date the copies of respective documents have been received. Conclusions shall be taken into account as the resolution on permit issuance is made.

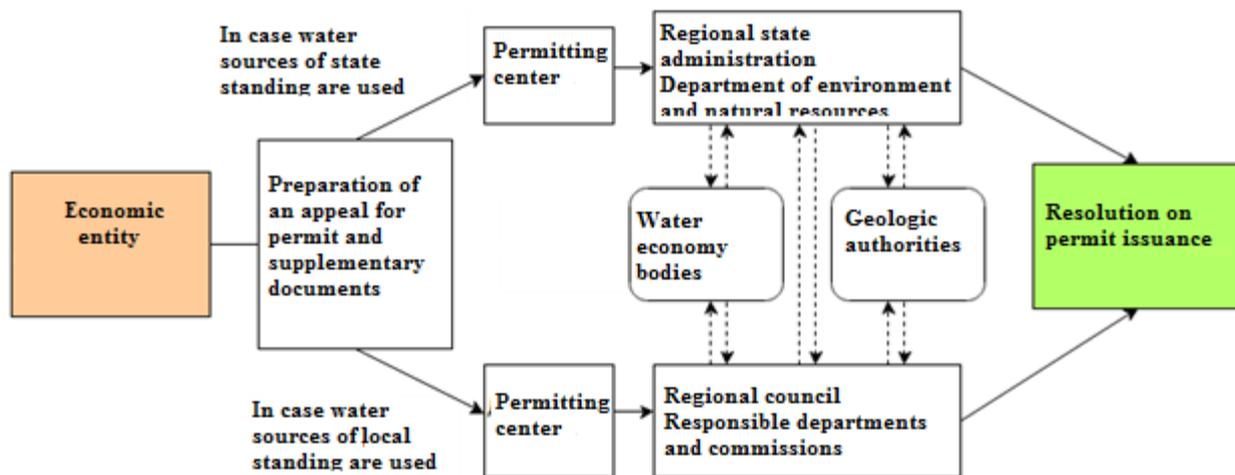


Figure 8. Schematic for obtaining permit for special water use

In case application or permit issuance is denied water user is provided with a reply outlining the reasons of such denial.

The permit provides for:

- name of authority which issued the permit;

⁵⁰ The Water Code of Ukraine <http://zakon4.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80/>

⁵¹ The Order of the State Committee of Ukraine on water economy # 41 dated 03.06.97 "On Approval of the List of Rivers and Ponds of Local Standing" <http://zakon4.rada.gov.ua/laws/show/z0002-98>

⁵² The Law of Ukraine "On amending some legislative acts of Ukraine and reducing the number of permitting documents" <http://zakon2.rada.gov.ua/laws/show/1193-18/page>

⁵³ Comments of the State Service of Ukraine on the issues of regulatory policy and business development, issued to the Law of Ukraine dated 09.04.2014 #1193-VII "On amending some legislative acts of Ukraine and reducing the number of permitting documents" <http://www.dkrp.gov.ua/info/3514.htm>

- name and properties of water user - legal entity (name, last name and patronymic, address of the water user being a physical entity);
- permit validity period;
- water take and use limits, limits of contaminants discharge;
- special water use conditions;
- other information (if needed).

In event of water shortage limits of water use can be reduced by specially authorized state bodies without any amendment of the special water use permit.⁵⁴

Special water use can be short term (up to three years) or long term (from three to five years).

In case the conditions of special water use remain unchanged the term of special water use permit can be extended upon application of the water user but not more than for the period of respective short or long term water use. The extension is provided by the authority which issued the main permit. Respective note is done in the permit.

Samples of the permit and applications forms, the list of data which shall be submitted by water users obtaining a permit shall be approved by the joint order of the Ministry of Natural Resources, Ministry of Health and State Water Agency. However as of current moment there is no such order adopted and regulatory authorities are guided by the "Instruction on procedure of approval and issuance of special water use permits" approved by the Ministry of Water Economy of USSR on 30.12.1983 № 354. Instruction is used in part which does not contradict the current laws of Ukraine, namely in part which provides the form of the specified application.⁵⁵

Issuance of permits and approval of applications is free of charge.

Term of special water use issuance or providing written notification of denial in its issuance shall be sent to water user within thirty calendar days from the date the application and respective documents have been submitted for review.

Copies of the permits issued shall be provided by the water users to respective bodies of state sanitary and epidemiological service and water economy authorities.

As groundwater are used for process needs and in case total designed productivity of all water supply sources within the allotted land plot exceeds 300 cubic meters a day special permit (license) for subsoil use is also required.

Special permits for subsoil use are issued by bodies specially authorized by central executive authority on geologic exploration and reasonable subsoil use (State Geologic and Subsoil Service of Ukraine) after preliminary approval with local bodies of the Ministry of Environment, State Mining Control and Ministry of Health.

Waste waters management requirements

In compliance with the Water Code of Ukraine requirements the water user shall⁵⁶:

- adhere to set norms and border values of contamination substances discharge and contamination substances discharge limits;
- control quality and volumes of flow back water and contaminating substances discharged into water sources, monitor water quality in control belts of water sources and submit reports thereof to respective authorities;
- carry out approved by special procedures measures on suspending contaminated waste waters discharge.

⁵⁴ The Water Code of Ukraine <http://zakon4.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80/print1390560558104246>

⁵⁵ Letter of the State Agency of Water Resources of Ukraine "On Procedure of approval and issuance of special water use permits" dated 03.10.2013 № 5076/9/11-13 <http://dt-kt.com/lyst-derzhavnoho-ahentstva-vodnyh-resursiv-ukrajiny-schodo-poryadku-pohodzhennya-ta-vydachi-dozvoliv-na-spetsvodokorystuvannya-vid-03-10-2013-r-5076911-13/>

⁵⁶ The Water Code of Ukraine <http://zakon4.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80/print1390560558104246>

Law sets forth the prohibition on startup of the new and modernization of existing and other facilities which are not equipped with the tools and treatment units of needed capacity aimed at preventing contamination and littering of water and harmful impact and those not equipped with metering devices to control volumes of water supply and discharge.

Water users shall carry out measures to prevent discharge of waste waters or its suspension if they can be used in the flow back water, secondary and subsequent water supply systems.

In case it is impossible to re-use waste water they can be discharged into water sources after proper treatment.

Treatment of drilling waste water can be carried out by using physical and chemical, mechanic and biological means. Special technology or equipment designed for contaminated water treatment directly in the pits shall be used for these purposes. Selection of methods and technology of wastes neutralizing is defined in design documents and depends on the level of waste toxicity and process capacities of drilling company. However all requirements of environmental protection laws shall be observed.⁵⁷

Discharge of the waste waters into water sources is allowed on condition the special water use permits are obtained and all waste waters discharge limits set in it are adhered.

In case substances, for which discharge limits have not been set, are present in waste waters or in case the border values of discharge are exceeded the water user shall carry out measures aimed at preventing or suspending of waste waters discharge. Waste waters discharge into surface water sources can be limited, temporary prohibited (suspended) or ceased under procedure set forth by current laws.

Waste waters discharge location shall be downstream of the settlement borders at distance which eliminates impact of surging phenomena (water movement stipulated by wind force).

Needed level of treating waste waters discharged into water sources is defined by norms setting forth the border discharge values (BDV) for contaminating substances.⁵⁸

Border discharge values (BDV) of a substance is a factor of maximum allowable substance volume discharged with backwater into surface water per time unit which, taking into account limitations set for this specific substance discharged from other sources, guarantees compliance with norms of the substance content in the set monitoring channels (points) of water sources.

Norms on contaminating substances content in water sources are defined by water quality norms. They include general requirements on physical, chemical and biologic parameters of water (temperatures, water pH factor, odor, taste, toxicity and others) as well as limitations on maximum allowable concentrations (MAC) of contaminating substances in water sources.

Norms of water quality depend on water sources use category:

- for household and potable water (sources of household and potable water supply, water supply for food industry enterprises) and household utility water (water sources use for swimming, sports and recreational activities, including water sources located inside of the settlements) sanitary and hygiene norms of water quality are set forth;⁵⁹
- for fishery (water sources which can be used for industrial fisheries and other water sources important for fish reserves restoration) fishery norms of water quality are applied⁶⁰.

⁵⁷ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

⁵⁸ Decree of the Cabinet of Ministers of Ukraine №465 dated 25.03.1999 «On approval of the Regulations on surface water contamination with waste waters» <http://zakon2.rada.gov.ua/laws/show/465-99-%D0%BF>

⁵⁹ SanR&N 4630-88. Sanitary norms and regulations on groundwater protection. <http://zakon3.rada.gov.ua/laws/show/v4630400-88>

⁶⁰ Generalized list of maximum allowable concentrations (MAC) and approximately safe impact levels (ASIL) of contaminating substances for fisheries water sources/

Control of quality norms adherence is carried out in monitoring channels. Monitoring channels are defined by the bodies of the Ministry of Natural Resources of Ukraine subject to approval with the Ministry of Health of Ukraine and Derzhrybgosprom (State Fisheries Service) of Ukraine.⁶¹

Location of the monitoring channel is defined based on specific conditions, however:

- for household and potable and household utility water use categories the norm is: not less than 500 meters lower than the backwater discharge point and one kilometer higher than the closest water use point;
- for fisheries water use category - not less than 500 meters lower than the backwater discharge point.

Norms of maximum allowable discharge (MAD) for contaminating substances is set forth with purpose of gradual achievement of environmental norm of water quality, i.e. scientifically justified values of contaminating substances' concentrations and water quality parameters (general, biologic, chemical and radiation) as well as sanitary and hygiene norms in water supply and consumption points, ensuring environmental safety of people's and water eco-systems living.

MAD norms are set forth for economic facilities started into operations and those which are being designed or constructed. Such norms are set forth in compliance with the list of contaminating substances discharge of which into surface waters is subject to norming. Contaminating substances being normed are as follows:

1. Dissolved oxygen (mg/l)
2. Balm substances
3. Water salinity
4. Sulphates
5. Chlorides
6. Nitrogen Ammonia
7. Nitrates
8. Nitrites
9. Phosphates
10. Petroleum products

Besides physical and chemical parameter are subject to mandatory norming. Such parameters include biochemical oxygen consumption (BOC 5), chemical oxygen consumption (COC), permanganate oxidation and bichromate oxidation, water toxicity level (based on bio-testing), parameters of bacteriologic contamination and level of water radioactivity (total radioactivity), pH factor and temperature.

Other substances, in case present in waste waters, are also subject to norming. Namely, the laws define the list of substances discharge of which shall be suspended (e.g. benzole, ethyl-benzole, cadmium, polycyclic aromatic hydrocarbons and many others) and the list of substances discharge of which shall be reduced (nitrogen, alumina, glycerin, sodium, petroleum products, surfactants and many others).

The list contaminants subject to norming shall be reviewed and amended by the Ministry of Natural Resources and approved by the Cabinet of Ministers of Ukraine (once every three years).

Design of MAD norms for contaminating substances discharged with backwaters of the enterprises, institutions and organizations shall be performed in part of compiling pre-design (TEE and TEC) and design estimate documents (design, detailed design) for new construction, extension, upgrade or technical modernization. Norms are designed under contracts concluded with specialized institutions (Ukrainian Scientific Center of Water Protection of the Ministry of Natural Resources of Ukraine (headquarters), its state subsidiary South Scientific Research

⁶¹ The order of the Ministry of Environment Protection of Ukraine #116 dated 15.12.94 «On Approval of the Instruction on Development and Approval of Maximum Allowable Discharge of Backwaters» <http://zakon1.rada.gov.ua/laws/show/z0313-94/>

Technical Environmental Enterprise or other institutions which obtained permit from the Ministry of Natural Resources of Ukraine upon respective certification) upon water user's request and on the basis of initial data obtained upon inventory of content and properties of backwaters and in compliance with the list of contaminating substances discharge of which is subject to norming and mandatory identification, backwater rates and other necessary data.

MAD norms are approved by bodies authorized to issue permits for special water use and are provided to the water user simultaneously with respective permit. MAD validity period is defined case-by-case by bodies authorized to issue permits for special water use and depend on the special water use permit term.⁶²

To agree and approve the drafts of MAD water user shall submit the following:

- justification materials (explanatory note) including initial data, legal and methodological justification, calculation conditions, calculation of MAD for specific substances and proposals on water protection measures;
- MAD calculations for specific substances, Actions Plan on MAD achievement.

MAD calculations shall not be reviewed in case the justification materials are not submitted.

MAD justifications shall include results of the following stages of work performance (shall be included as sections of explanatory note)⁶³.

1. Preparation of the initial data for MAD calculation for specific substance:

- a) sanitary and technical inspection of the discharge source, calculation of contaminating substance concentration in backwater (analysis or using data of analysis which has been performed already);
- b) collecting initial data for MAD design (data on water sources, water users on the basin's territory or its part, etc.)
- c) compiling hydrographic scheme of administrative unit (region) marking all water take, backwater discharge and other water points.

2. Legal and methodological justification of scheme and model of MAD calculation for specific substances based on water use specifics (types of water use and limiting monitoring channels, type of backwater, water source, etc.)

3. Determining calculation conditions and preparation of MAD design (calculation) for specific substance:

- a) processing of metering data for losses and chemical analysis of backwater composition and properties;
- b) calculation of hydrologic regime and background water quality in the water source (taking into account natural water quality data);
- c) compiling a scheme of backwater discharge points of the water user;
- d) calculation of the allowable concentrations and MAD for specific substances providing data on calculation method used.

4. Definition of temporary approved substances' discharge values and calculation of water quality in the water source used to assess efficiency of achievement of temporary approved discharge and MAD amounts.

5. Preparation of draft of the Action Plan designed to achieve MAD and compile MAD design, temporary approved discharge amounts and Action Plan (to agree and approve).

⁶² Decree of the Cabinet of Ministers of Ukraine # 1100 dated 11.09.1996 "On Procedure of design and approval of maximum allowable discharge of contaminating substances and list of contaminating substances discharge of which is subject to norming.

⁶³ The order of the Ministry of Environment Protection of Ukraine #116 dated 15.12.94 «On Approval of the Instruction on Development and Approval of Maximum Allowable Discharge of Backwaters» <http://zakon1.rada.gov.ua/laws/show/z0313-94/>

Justification materials (explanatory note) shall be amended with references of approval:

- a) initial data on water source (type of water use, limiting monitoring channel, actual background water quality, etc.) - with local body of the Ministry of Natural Reserves of Ukraine;
- b) location of backwater discharge points in regard to settlements' borders - with local body of architecture and construction;
- c) data on calculation (including natural) background water quality, introduced backwater treatment technology.

Documents submitted shall be reviewed and approved by the bodies of the Ministry of Health of Ukraine within two weeks. Within a month they shall be reviewed and approved by the bodies of the Ministry of Natural Resources of Ukraine. In case bodies of the Ministry of Health of Ukraine have refused to review or unreasonably rejected materials submitted, bodies of the Ministry of Natural Resources of Ukraine shall have the right to independently resolve the issue of MAD and Action Plan on their achievement approval.

MAD review shall be performed not rarer than once every five years. Special water use permit shall not be issued without MAD approved.

Discharge of any substances related to activities carried out by water user but not specified in MAD design shall be prohibited.

Companies, institutions and enterprises which have contaminated waste water's settlers shall apply efficient processes to neutralize and dispose such waters and perform soil reclamation on the areas where such settlers are located. Discharge of such waters into surface water sources shall be performed under special regulations approved by local regional state administrations.

Unless discharged into surface water sources waste waters from oil and gas companies can be buried. However, making polygons in deep ground aquifers, which do not contain sweet water, for burial contaminating substances, production wastes and waste waters is allowed in exceptional cases after special survey has been performed and permit of respective central executive authority implementing state environmental protection policy has been granted. Such burial is performed under design documents approved with central executive authority implementing state sanitary and epidemiological welfare of population policy, with central executive authority implementing state labour protection policy and respective local council.

Drilling waste water shall not have any harmful impact on formation bottomhole zone or be biologically active and corrosive. As waste waters are buried in injection horizons requirements on their quality and composition shall be adhered to⁶⁴:

- petroleum products up to 50 mg/l;
- solid particles up to 30 mg/l;
- pH – from 5 to 9.

If parameters of treated drilling waste waters do not exceed the following values:

- petroleum products from 50 mg/dm³ up to 100 mg/dm³
- salinity not more than 4500 mg/dm³;
- pH – from 5.5 to 8.2.

Thus, in compliance with GOST 17.4.3.05 such water can be occasionally discharged on soil on the drilling site. In case treated waste water parameters do not correspond to above mentioned norms it shall be additionally cleaned with cleaning agents and flocculants or other types of known and available means (filtration on sand and gravel areas, absorbent treatment).

⁶⁴ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

Associated formation water on oil and gas fields is returned to formations under process design schemes approved by central executive authorities implementing state policy of environment protection and central executive authority implementing state policy of sanitary and epidemiological welfare of population.

Groundwater's protection requirements

Companies, institutions and organizations activity of which can negatively impact groundwater condition, especially those which operate waste or sewage settlers, shall carry out measures preventing contamination of groundwater and drill local monitoring wells' networks to control quality of groundwater.⁶⁵

Hydrocarbon production is related to risk of groundwater contamination due to the following process factors⁶⁶:

- geo-filtration of liquid wastes;
- contamination of ground potable waters due to cross-flows in rock thicknesses occurring due to casing damage and poor cementing;
- poor quality pit, process areas insulation or its damage;
- pipeline highly saline water leaks, destruction of soil bundles arranged around sludge pits, spills of fuel and lubricants;
- breach of requirements at execution of loading, transporting and storing of chemical agents used to mix circulation and cementing slurries.

Safety rules of oil and gas industry of Ukraine set forth specific requirements to cement jobs and casing running ensuring tightness of the well and avoidance of aquifers' contamination.⁶⁷

In compliance with the rules, the height of surface, conductor and intermediate casing annular space fill with cement slurry in all wells shall be performed to surface.

Casing which is supplied to drilling site shall have quality certificates. Preparation of domestically manufactured casing for RIH shall be performed on pipe yards where hydrotesting of pipe, thread inspection, drifting, marking, sort-out and metering of pipe length together with visual inspection is performed. Imported casing before RIH shall be drifted, marked, sorted-out, measured and visually inspected. Use of domestic casing for which defectoscopy has not been performed on the manufacturing mill is prohibited.

Casing RIH regime, selection of cement slurries and materials and hydraulic cementing plan shall be calculated and fulfilled in the way that they provide potential over balance of productive intervals and prevent complications related to HF and lost circulation. During cementing parameters of the work process shall be recorded.

Use of cement slurries and materials shall be performed taking into account static temperatures in the well along the whole cemented interval, dynamic temperature and pressure, expected in cemented interval, preventing rock fracturing under hydrodynamic pressure impact. Use of cement without prior laboratory analysis of its compliance with cementing conditions in casing and cement bridge installation conditions is prohibited.

RIH and cementing of casing is performed in compliance with the plan prepared by drilling contractor and approved under procedure set forth.

In compliance with Standard of State Geologic Service of Ukraine. "Environment Protection" environmental protection measures during oil and gas wells drilling aimed at preventing contamination of subsoil horizons with sweet and mineral waters shall include the following work scope:

⁶⁵ The Water Code of Ukraine <http://zakon4.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80/print1390560558104246>

⁶⁶ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

⁶⁷ Order of State Committee of Ukraine on Industrial Safety, Labour Protection and Mining Control # 95 dated 06.05.2008 «On Approval of Safety Regulations for Oil and Gas Production Industry in Ukraine" <http://zakon2.rada.gov.ua/laws/show/z0497-08/>

- determining sanitary protection zone around water wells and wellhead hook-up thereof;
- timely abandonment of water wells which were used for designated purposes or their transfer to interested parties in compliance with current legal documents;
- drilling, in specific cases, monitoring wells penetrating the first from surface water formation - decision on drilling monitoring wells is made by the company preparing design documents for well construction;
- application of methods for penetration and completion of aquifers preventing contamination of groundwaters;
- at penetration of formations which can be used as potable and household water suppliers circulations fluids containing new chemicals shall be allowed only upon approval thereof with the Ministry of Natural Resources of Ukraine; use of I and II hazard class chemicals shall be prohibited;
- reliable shut-off of the aquifers shall be ensured.

List of measures providing protection of surface and groundwater from contamination with drilling wastes shall include:

- treatment of circulation fluid and flow back water, waterproof insulation of the area, and, if needed waterproof insulation of the pits;
- gathering, disposal, neutralizing, burial of drilling wastes in sludge pits on the work site;
- removal during pitless drilling of the processed liquids and cuttings to special sites, location of which shall be preliminary approved with bodies of the Ministry of Health of Ukraine and Ministry of Natural Resources of Ukraine;
- gathering, use, disposal and utilization of the products of well completion, fuel and lubricating materials wastes.

In sanitary protection zones of resorts, health resorts, sanatorium, where mineral water sources are located, drill works are allowed only on condition the conclusion of territorial geologic and sanitary-epidemiological bodies is available stating that drilling will not negatively impact mineral water sources. Drilling in sanitary-protective and recreational zones shall be pitless and household and utility water supply volumes shall be stored in special tanks, neutralized and transported to local treatment facilities.

In case aquifers of potable water are penetrated persons, performing drilling, mining and other works related to exploration, appraisal and operation of fields shall inform regional state administrations, central executive authority implementing state policy of geologic exploration and reasonable subsoil use and central executive authority implementing state policy of sanitary and epidemiological welfare of population on measures taken to protect groundwater from contamination and depletion.

All water wells not suitable for operation, abandoned monitoring wells and exploration wells drilled for all kinds of mineral reserves shall be cemented or abandoned. Cementing during abandonment of exploration wells shall be performed by companies which carry-out exploration. Cementing on non-suitable for operations or abandoned producing and monitoring wells shall be performed by the company which has those wells on their balance. In case it is impossible to define the owner of well its abandonment is performed based on the resolution of the local councils by central executive authority implementing state policy of geologic exploration and reasonable subsoil use.

In case the groundwater resources have depleted and in case groundwater has been contaminated the reasons thereof shall be defined. Upon proposals of central executive authority implementing state policy of state supervision (control) over environment protection and reasonable use, restoration and protection of natural reserves, central executive authority implementing state policy of geologic exploration and reasonable subsoil use, shall defined persons at fault at expense of which restorations measures will be carried out.

Monitoring, reporting and state supervision

Monitoring of water sources is divided into state monitoring and monitoring performed by water users in compliance with requirements of the Water Code of Ukraine.



Figure 9. Water sampling for water quality analysis. Photo: Shell Company

State water monitoring is a part of state environmental monitoring system of Ukraine. It is carried out in order to ensure collecting, processing, storing and analyzing data on water quality, predicting its changes and developing scientifically justified recommendations allowing making managerial decisions related to use and protection of waters and restoration of water resources.

Key requirements on state water monitoring are set forth by Unified Multiagency Board on Arrangement and Performance of State Water Monitoring.⁶⁸

Arrangement of monitoring of surface waters quality (placement of monitoring points, definition of monitoring channels location and verticals therein, definition of sampling horizons on the verticals and development of monitoring programs) is regulated under GOST 17.1.3.07.⁶⁹

For each monitoring point the specific document is compiled (passport of monitoring point). It defines technical parameters of the point, i.e. description, codes and numbers of the water sources, channel, vertical and horizons, maps and layouts of the water source and the area of monitoring point location, purpose and program of monitoring as well as additional data of hydrologic parameters of the water source and its contamination sources.

During visual monitoring phenomena unusual for specific region of the water source are observed. Such are presence of floating admixtures, tape, oil spots, inclusions or other particles; development, cumulations or die away of seaweeds, fish and animal kill, mass outlier of shellfish (mussels), increased water silt content, unusual water color, foaming and others. Analysis is made based on certified methods (chemical analysis, determining biologic parameters, and toxicology analysis). Water from the sources and particles contained as well as bottom sediments shall be analyzed.

To control condition of the groundwater and to carry out timely specific measures on its protection all centralized water take points shall have the network of monitoring wells in order to perform systematic observations of quality and level of groundwater on either water take or

⁶⁸ Unified Multiagency Board on Arrangement and Performance of State Water Monitoring. Approved by the Order of the Ministry of Environment and Natural Resources of Ukraine # 485, 24.12.2001 <http://zakon.nau.ua/doc/?code=v0485556-01>

⁶⁹ GOST 17.1.3.07-82. Environment protection. Hydrosphere. regulations on water quality control in water ponds and water streams.

adjacent area, within the pressure sink. These observations are performed to control environmental impact of water take (including water supply sources) and timely determining and forecast of contaminated or off-spec natural water inflow to water take. On groundwater takes used for water supply analysis within the first year is done not less than 4 times a year (every season). In the following years analysis is done not less than once a year.

Laboratory control of the groundwater quality is performed by the company contaminating groundwater. Territorial bodies of the State Sanitary and Epidemiological Service of the Ministry of Health of Ukraine perform random control of chemical, radiologic and bacteriologic contamination parameters, impacting population health. Geologic territorial bodies of the Ministry of Environmental Resources control parameters of water salinity, hardness and chemical contamination.

Monitoring points where water samples are taken for chemical composition analysis shall be selected in a way that would allow describing typical aquifer's zones. First of all such points are determined on the crosses of the contaminants flow or in places where the main contamination sources are located.

Regularity of sampling is defined based on the contamination flow speed. Sampling shall be performed not less than once a quarter for the well closest to contamination zone and once every half a year for the wells more remote from contamination zone. Sampling is done once a month in the wells which are located in the contamination zone. It is desirable to take samples in the middle of the quarter or in the middle of the year. At abrupt change of hydrogeologic conditions (for example in karstic regions) sample can be taken once a month or oftener. Further, sampling frequency shall be adjusted depending on results of chemical analysis of samples taken before.

In compliance with requirements of the Water Code of Ukraine subsoil users shall control the volume of water used, volumes of waste waters and content of contaminants therein, quality parameters of natural waters downstream of waste water discharge (control channel).

Sampling on the first area and its frequency is done by the subsoil user upon approval with local environmental authority.

During drilling oil and gas wells in environment protective areas, recreational territories or shore-land belts of rivers and water storages a network of monitoring wells shall be designed for the shallowest aquifer. That is aimed at control of water quality and carrying out timely measures to prevent contamination of surface and groundwater. Control periods are defined by the term of biologic reclamation.

Drilling monitoring well network shall also be done if the drilling periods are longer than three years. The number of monitoring wells depends on size of sludge pits, parameters of underlying soils and hydrogeologic peculiarities of the drilling area. As a rule maximum density of the network shall correspond to the flow of groundwater from water shed to discharge zone. The best distance between the wells in the specified areas shall be 10-15 meters.

Stationary monitoring of the water wells is performed to define interconnection between the shallowest aquifer and the system of sludge pits (impact on the deepest groundwater horizon and speed of migration of contaminating components of mud filtrate and waste water).

Hydrogeologic stationary monitoring is performed to:

- define groundwater horizon filtration index;
- monitor level, direction and speed of groundwater movement;
- monitor amplitude of seasonal and annual fluctuation of groundwater level;
- control over groundwater quality which shall be performed not less than once a quarter.

Controlling quality of groundwater such parameters as pH factor, chemical oxygen consumption (COC) and overall salinity of groundwater are defined. Results obtained are compared to initial

values of specified parameters. Upon requirements of controlling authorities extended analysis of water produced may be performed.⁷⁰

Water users shall ensure installation and application of tools aimed to perform regular monitoring of the volume and quality of flow back water, assist employees of supervising bodies in inspections and sampling performed in monitoring channels and in water supply systems, including those performed outside the area where facilities of the water users are placed.⁷¹

Based on monitoring data water user prepares and submits to statistics authorities the following forms of primary accounting of water use:

- POD-11 "Log of water use accounting (water permit) by water metering devices and equipment";
- POD-12 "Log of water use accounting (water permit) by secondary means". It is applied in companies where metering devices are not available;
- POD-13 "Log of discharged sewage water accounting". Is applied in companies which discharge return waters into natural water sources (surface or ground) and waters discharged into urban sewage systems, etc.

Primary accounting logs POD-11, POD-12 and POD-13 are not statistic forms, however they are mandatory and can be checked by specialized authorities.

Mentioned logs are the basis for further quarterly statistics reports under 2-TP form (water economy) - "Report on Water Use". 2-TP form (water economy) shall contain data on water consumption, water permit, budgetary payments charged for special water use and other data. 2-TP form (water economy) statistics report is submitted quarterly and annually.

State Environmental Inspection executes state supervision (control) of adherence to laws on protection and reasonable use of waters, restoration of water sources. State supervision is also related to availability and adherence to conditions of permits issued, set norms of maximum allowable discharge of contaminating substances, limits of water take and discharge of contaminating substances, adherence to rules of primary accounting carried out by water users for waters taken from water sources and discharged therein, determining water quality.⁷²

Besides, State Environmental Inspection and its territorial bodies execute state control over protection and reasonable use of waters, carrying out measures on protection of waters from contamination, littering and exhausting, operations of treatment and other water protection facilities on which flow back water is discharged, adherence to legal regime of economic activity in water protection areas and on shore-land protection belts.⁷³

⁷⁰ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

⁷¹ Decree of the Cabinet of Ministers of Ukraine №465 dated 25.03.1999 «On approval of the Regulations on surface water contamination with waste waters» <http://zakon2.rada.gov.ua/laws/show/465-99-%D0%BF>

⁷² Decree of the President of Ukraine # 454/2011 dated 13.04.2011 "Regulations on State Environmental Inspection of Ukraine" <http://zakon1.rada.gov.ua/laws/show/454/2011>

⁷³ Decree of the Cabinet of Ministers of Ukraine №465 dated 25.03.1999 «On approval of the Regulations on surface water contamination with waste waters» <http://zakon2.rada.gov.ua/laws/show/465-99-%D0%BF>

5. Waste management requirements

In course of natural gas protection solid (drilled rock, cuttings, chemicals, etc.) and liquid (drill mud, hydrofracturing mud, flow back water, etc.) wastes are formed. They need to be properly disposed to prevent negative environmental impact.

Depending on drilling method and hazard class solid drilling wastes shall be⁷⁴:

- deactivated and buried in pits on drilling site;
- deactivated and buried on industrial wastes polygons;
- buried on polygons or specially allotted sites, developed under design documents in compliance with SN&R2.01.28/

Economic entities carrying out waste management activities shall⁷⁵:

- prevent forming and reduce volumes of wastes produced;
- define composition and properties of wastes produced and the level of waste hazard to environment and human health;
- differentiate and account volume, type and composition of wastes produced, gathered, transported, stored, processed, disposed or utilized, deactivated and removed. Such shall be performed on the basis of material and raw material operational balance whereas respective data shall be included into statistics report submitted under special procedure;
- ensure full gathering and proper storing, preventing destruction or damage of wastes for which specific disposal technology is applied in Ukraine in compliance with environmental safety requirements;
- prevent mixing wastes if that is not envisaged by existing process or complicates waste management or in case it is not proven that such actions correspond to enhanced environmental safety requirements;
- prevent storing and disposal of wastes on unapproved locations or facilities;
- control over condition of locations or facilities of self-produced wastes placement;
- provide to local executive authorities or local self-government bodies, authorized executive environment protection authorities data on wastes and activities related thereto, including data on unauthorized ingress of wastes into environment and measures carried out in connection therewith;
- appoint persons authorized in matters of waste management;
- reimburse damage incurred to environment, health and property of citizens, companies, institutions and organizations and resulting from breach of waste management requirements set forth by the laws of Ukraine;
- possess a license for hazardous waste management and/or permit from cross-border transportation of hazardous wastes;
- possess an approved with authorized executive authorities Emergency Response Plan for hazardous wastes management;
- possess a permit for carrying out activities related to waste management. Such permit is not required for the entities activities of which result in waste forming totaling to less than 1000 tons;
- fulfill other liabilities envisaged by laws and preventing environmental contamination with wastes.

Storing and disposal of wastes is carried out in places defined by the local self-government authorities taking into account requirements of land and environment laws. It is carried out on condition permit for waste management defining the types and volumes of wastes, general technical requirements and safety measures, data on waste production, purpose and methods of processing thereof, complying with storing conditions.

⁷⁴ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

⁷⁵ The Law of Ukraine "On Wastes" <http://zakon4.rada.gov.ua/laws/show/85/96-%D0%B2%D1%80>

Locations or facilities allotted for waste storing or disposal shall be used only for wastes stated in application for waste management permit.

Unauthorized disposal or placement of wastes, including household wastes, in subsoil horizons, in towns or other settlements, on preserved lands or lands of environment protective, recreational or historic and cultural designation, in water protective zones and sanitary protective zones of water sources, as well as in other places where they can create environment and human health threat shall be prohibited. Subsoil waste burial shall be allowed in exceptional cases based on results of special survey carried out in compliance with standards, norms and regulations set forth by laws of Ukraine.

Subsoil waste burial shall be allowed in exceptional cases based on results of special survey.

Waste classification, storage and transporting regulations

Production wastes and consumption areas depending on physical, chemical and biologic properties of the whole waste volume or its specific components are divided into 4 hazard classes:

- I class - extremely hazardous substances (wastes);
- II class - highly hazardous substances (wastes);
- III class - hazardous substances (wastes);
- IV class - low hazardous substances (wastes);

Hazard class is defined based on level of toxicity of industrial wastes. Toxic industrial wastes are wastes produced in course of technological industrial process and containing physiologically active substances causing intoxication effect.

Drilling wastes hazard class is defined by calculation based on physical and chemical waste composition.

Every industrial company shall develop instruction and actions plan for gathering and temporary placement (storing) industrial wastes on operational facilities. Such shall be prepared for I, II and III hazard class wastes respectively. As wastes are cumulated they are packed in compliance with safety rules in tare defined for each specific class. Those are then delivered for temporary storing to operational site (workshop, area, and warehouse) and are left in designated area for subsequent transportation to disposal location, deactivation or burial site.

For each waste storing location (facility) special passport shall be compiled. It shall define technical parameters of locations, description and coding of wastes (in compliance with state code list), quality and composition of wastes, origin, methods of control and safe operation of locations (facilities).

Waste storing regulations:

- I hazard class wastes shall be stored in tight tare (steel barrels, containers). As the tare is filled it shall be tightly closed with steel cover and if needed welded;
- II hazard class wastes shall be stored depending on their aggregate state in polyethylene bags, packing, barrels or other types of tare preventing release of hazardous substances (components);
- III hazard class wastes shall be stored in tare providing localized storing and allowing loading, unloading and transporting and eliminating release of hazardous substances into environment;
- VI hazard class wastes may be stored in open cone piles on operational area. Therefrom those are loaded on dump trucks and delivered to disposal or burial sites. Such wastes without negative environmental impacts can be mixed with household wastes on burial sites or used as isolating material for different types of site work at its preparation.

Transporting of hazardous wastes is allowed upon availability of waste passport and permit (license) issued by local authorities of sanitary and epidemiological and environmental services and obtained by transporting company for waste management. Transportation shall be performed

only by specially equipped transport means with special signs notifying the nature of their use. Drivers delivering industrial wastes shall pass special training on toxic wastes management. Transported waste volumes shall not exceed loading volume of respective transport means. Industrial wastes transportation shall not lead to environment contamination in locations of wastes loading, transporting and unloading.

All processes related to loading, transporting and unloading of I-III class wastes shall be automated. Transporting shall be performed by specially equipped transport means designed to transport respective class wastes. Transporting shall be carried out in integral tight tare preventing release of wastes (spill, dispersion) on the way, environmental contamination and providing convenience of loading-unloading operations.⁷⁶

If wastes are temporary stored on the outdoor operational areas of the company (in bulks or piles) or in loose, open packing, the following shall be ensured:

- concentration of hazardous substance in the air of the work area, at 2 meters height, shall not exceed 30% of the maximum allowable concentration in the work area air⁷⁷;
- concentrations of hazardous substances in soil of the sanitary-protective zone shall not exceed allowable levels⁷⁸, and in surface and groundwater it shall not exceed allowable border values⁷⁹;
- industrial area used for temporary waste storing shall be located on the territory of the company on a downwind side. It shall be covered with non-destructible and impermeable by toxic substances materials (clay-concrete pellets, polymer concrete. etc.) with a separate discharge and slope towards cleaning facilities.

Waste management permits

Permitting procedures established for operational activities shall differ for non-hazardous and other wastes.

Review of applications, calculated limits for production and placement of hazardous wastes, approval of such limits and issuance of permits for hazardous wastes placement is performed by the Ministry of Natural Reserves of Ukraine.

Hazardous wastes include substances defined in the Regulations on Control over Cross Border Transporting of Hazardous Wastes Defined in Yellow and Green Waste Lists and Disposal Thereof.⁸⁰

At the same time the list of permitting documents for specific economic activities⁸¹ does not include such document as a permit for hazardous wastes placement, and respectively in compliance with the latest changes in legislation related to permitting⁸² it is prohibited to demand from economic entities obtaining of permitting documents not defined in the specified list. This issue requires additional legal regulating.⁸³

In compliance with the latest changes only one permit for operations related to waste management is left in the list of permitting documents issued for specific economic activities.

⁷⁶ Resolution proposed the Ministry of Health of Ukraine to consider Decree of the Chief State Sanitary Doctor of Ukraine # 29 dated 01.07.199 <http://www.dkrp.gov.ua/print/3712> deforced.

⁷⁷ GOST 12.1.005-88. SSBT. General sanitary-hygienic requirements to work area air.

⁷⁸ MY 4266-87. Methodological instructions on evaluation of contamination hazard constituted by chemical substances.

⁷⁹ SanR&N 4630-88. Sanitary norms and regulations on groundwater protection.

⁸⁰ Decree of the Cabinet of Ministers of Ukraine №1120 dated 13.07.2000 «On Approval of the Regulations on Control over Cross Border Transporting of Hazardous Wastes and Their Disposal, in Yellow and Green Waste Lists" <http://zakon4.rada.gov.ua/laws/show/1120-2000-%D0%BF>

⁸¹ Law of Ukraine "On Permitting System in Economic Activity" <http://zakon4.rada.gov.ua/laws/show/3392-17>

⁸² The Law of Ukraine "On amending some legislative acts of Ukraine and reducing the number of permitting documents" <http://zakon2.rada.gov.ua/laws/show/1193-18/>

⁸³ Explanation of the State Regulatory Policy and Business Development of Ukraine on clarification of obtaining the hazardous wastes placement permit <http://www.dkrp.gov.ua/info/2803.htm>

Written consent (notification) on cross-border transporting of hazardous wastes and waste statement are also included into the list.⁸⁴

Applications prepared in part of calculation of limits for waste production and placement (except for hazardous) are submitted in permitting centers exclusively.

Additional expert review of applications and documents attached and submitted to obtain waste production and placement limits shall be prohibited.

Waste production limit is calculated by the owner in course of activities performance on the basis of the waste placement permit and under agreement (contract) on waste transfer to another owner. Limit for waste production is calculated on the basis of norms set forth for each type of wastes based on hazard class and shall be equal to total volume of wastes placed on the area or transferred to another owner.

Owners of wastes formed from recoverable materials, which carry out their statutory activity on gathering and fabrications of such wastes, as well as waste owners which are not subjects to inclusion into the list of waste production, processing and disposal facilities shall be exempt of the need to obtain waste limits.

Criteria for inclusion into the list of waste production, processing and disposal facilities is a factor of general waste production (P_{gwp}) calculated by formula:

$$\Pi_{3yB} = 5000 \times M1 + 500 \times M2 + 50 \times M3 + 1 \times M4,$$

where M1, M2, M3, M4 - are specific units values of which are equal to waste volumes formed on facility by hazard class (1, 2, 3, 4 classes respectively). The register includes facilities for which the parameter of general waste forming exceeds 1000 specific units a year.⁸⁵

Such entities shall annually submit to permitting centers of administrative services waste statements.

Regional state administrations upon submission of district state administration before February 1 of the current year shall prepare the list of waste owners who must obtain waste production and placement limits for the following year. Ministry of nature and regional state administrations before March 1 of the current year shall send to the waste owners notifications on the need to submit and obtain approvals for the drafts of waste production and placement limits for the following year.

Waste owners who carry out waste placement only before April 1, and waste owners who produce and place wastes on their own site - before June 1 of the current year, shall submit to the Ministry of Natural Resources and respective permitting centers applications for waste placement permit for the following year. The following is attached to application:

- the draft of waste production and placement;
- data on composition and properties of wastes produced and the level of their hazard for environment and human health;
- reference on allowable waste production limits;
- reference on specific parameters of waste producing; copies of active contracts (agreements) for waste transfer to other owners;
- reference on volumes of toxic volumes and their production, use and supply of wastes in kind of recyclable raw materials and production wastes for current year;
- conclusions of sanitary and epidemiological expert review on waste management facilities.

⁸⁴ Comments of the State Service of Ukraine on the issues of regulatory policy and business development, issued to the Law of Ukraine dated 09.04.2014 #1193-VII "On amending some legislative acts of Ukraine and reducing the number of permitting documents" <http://www.dkrp.gov.ua/info/3514.htm>

⁸⁵ The Decree of the Cabinet of Ministers of Ukraine №1360 dated 31.08.1998 «On Approval of Procedure on Waste Forming, Processing and Disposal Register" <http://zakon2.rada.gov.ua/laws/show/1360-98-%D0%BF>

Ministry of Natural Resources and regional state administrations shall review applications till July 1 and issue permits for wastes placement or send to waste owners notifications specifying the reasons of refusal to issue a permit and defining the term of the next submission of needed documents.

On the basis of the permit obtained waste owners prepare adjusted drafts of waste production and placement limits and before September 1 of the current year submit those for approval to the Ministry of Natural Resources (for hazardous wastes) or regional state administrations (for other wastes). Approved limits for hazardous wastes production and placement are transferred by the Ministry of Natural Resources to regional state administrations.

Drafts of limits for waste production and placement shall be reviewed and approved or rejected by regional state administrations within two weeks. In case of rejection of submitted limits the letter specifying the reasons thereof and the term of additional review shall be sent to waste owner.

The permit comes into force as waste production and placement limits are approved. Waste production and placement limits are set for three years and are informed to waste owner before October 1 of the current year.⁸⁶

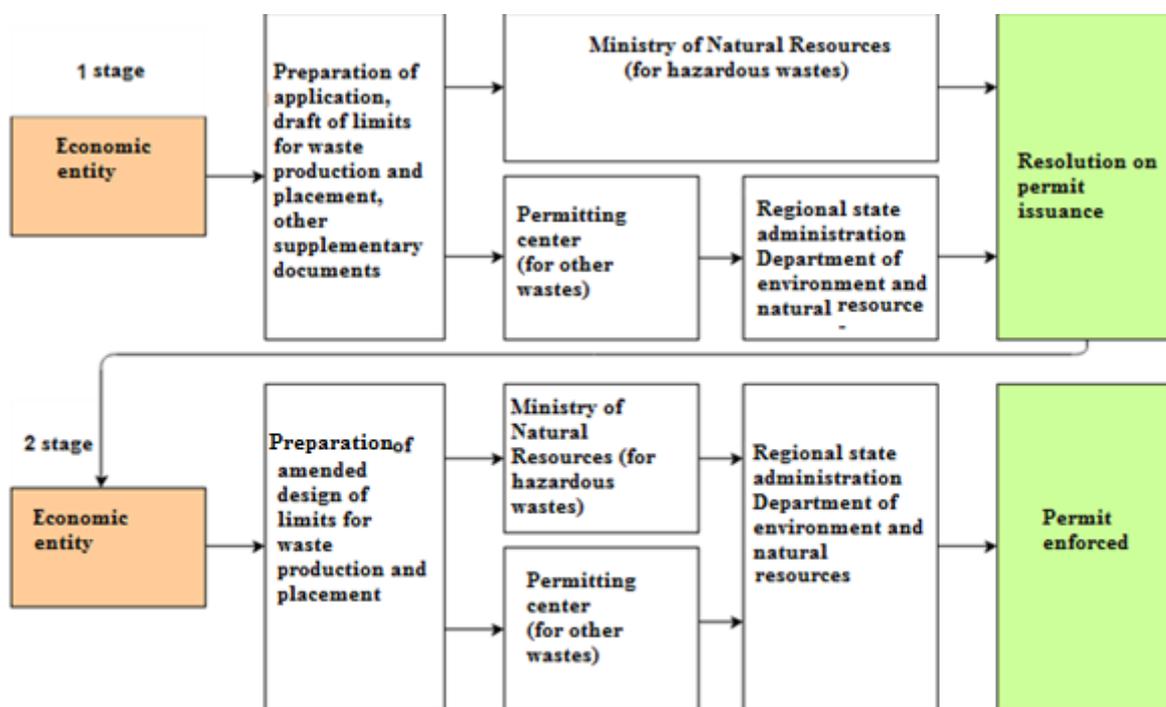


Figure 10. Schematics of obtaining a permit for operations in sphere of waste management.

Companies carrying out gathering, transporting, storing and processing, disposal, removal, neutralizing and burial of hazardous wastes shall also obtain a license for operations in hazardous waste management sphere. License is issued by the Ministry of Natural Resources. An entity shall not obtain the license for storing produced hazardous wastes in case such wastes within a year after they were produced have been transferred to entities possessing a license for hazardous wastes management.⁸⁷

To obtain a license for hazardous wastes management an entity shall submit to the Ministry of Natural Resources a standard form application⁸⁸.

The following documents are attached to application:⁸⁹

⁸⁶ Decree of the Cabinet of Ministers of Ukraine №1218 dated 3.08.1998 "On Approval of the Procedure of Design, Approval and Review of Waste Production and Placement Limits" <http://zakon4.rada.gov.ua/laws/show/1218-98-%D0%BF>

⁸⁷ The Law of Ukraine "On Licensing Certain Types of Economic Activity" <http://zakon1.rada.gov.ua/laws/show/1775-14>

⁸⁸ The Order of the Ministry of Natural Resources # 433 dated 04.11.2011" On Approval of License Provisions for Hazardous Wastes Management Activities" <http://zakon1.rada.gov.ua/laws/show/z1549-11>

- information on material base needed to carry out waste management activities;
- information on availability of own or leased areas (premises);
- information on persons authorized in matters of waste management;
- list of hazardous wastes types for which the license is requested;
- copy of the passport for wastes removal location (in case removal or burial of hazardous wastes is performed);
- copy of insurance certificate for incurrence of liability in case of negative impact (in case transportation of hazardous wastes is carried out);
- positive conclusion of state environmental expert review issued for design documents prepared for facilities on which hazardous wastes are managed;
- positive conclusion of state sanitary and epidemiological expert review issued in respect of adherence to safety requirements on facilities on which hazardous wastes are managed;
- registration card of the facility where wastes are processed and disposed.

License holder shall inform license issuing authority on change of any data provided in documents submitted together with license issuance request.

Monitoring, reporting and state supervision

Laboratory control over environment condition in the region of waste disposal sites (locations) shall be performed by authorized sanitary industrial laboratories of the companies. Periodically such control shall be carried out by state sanitary and epidemiological service bodies, bodies of water monitoring, environmental safety applying standard methods of defining content of contaminating substances in air, water and soil: regularity of control, metering points and list of hazardous substances monitored shall be approved with local self-government authority, state sanitary and epidemiological service and other supervising bodies.⁹⁰

State accounting of wastes is based on the observation data on waste production and waste management and includes primary accounting of wastes and submitting state statistics reporting thereon.⁹¹

Primary accounting is performed by the companies in compliance with standard primary accounting forms (cards, logs, check-lists) applying process, normative and technical, economic, accounting and other documents.

Primary reporting form # 1-BT "Accounting of wastes, packing materials and tare"⁹². 1-BT typical form does not include:

- data on substances (products, entities) being a prepared product meant for further use;
- semi-processed materials meant for further processing aimed at final goods production;
- wastes discharged to water sources with waste waters or emitted into ambient air;
- used wastes or packing, amount of which it is impossible to define due to process peculiarities.

The form shall be filled in kind of bound pages log filled-in for each type of wastes produced on a single facility or in one process cycle.

⁸⁹ The Decree of the Cabinet of Ministers of Ukraine # 756 dated 04.07.2001 "On Approval of the List of Documents Submitted with Application for Licensing Specific Economic Activity" <http://zakon2.rada.gov.ua/laws/show/756-2001-%D0%BF>

⁹⁰ Hygienic requirements on industrial wastes management and determining class of waste hazard related to human health" SSanR&N 2.2.7.029-99 <http://www.dsesu.gov.ua/ua/normativna-pravova-baza/sanitarni-pravyly-i-normy/file/71-3170-84?start=40> See also Resolution of the State Service of Ukraine of Regulatory Policy and Entrepreneurship development # 33 dated 15.07.2014 "On the need to eliminate by the Ministry of Health of Ukraine breaches of state regulatory policy "On fundamentals of state regulatory policy for economic activities". Resolution proposed the Ministry of Health of Ukraine to consider Decree of the Chief State Sanitary Doctor of Ukraine # 29 dated 01.07.199 <http://www.dkrp.gov.ua/print/3712> deforced.

⁹¹ Decree of the Cabinet of Ministers of Ukraine # 2034 dated 01.11.1999 "On Approval of Procedure on State Accounting and Certification of Wastes" <http://zakon3.rada.gov.ua/laws/show/2034-99-%D0%BF>

⁹² The Order of the Ministry of Natural Resources # 342 dated 07.07.2008 "On Approval of the Standard Form of Primary Accounting Document # 1-VT "Accounting of wastes, packing and tare" and "Instruction of filling-in the standard form" <http://zakon1.rada.gov.ua/laws/show/z0824-08>

State statistics report on wastes is prepared on form 1-wastes "Waste Management". It is mandatory for legal entities which produce, dispose, process and store I-IV hazard class wastes. The form is filled annually.⁹³

Companies fill in the form of statistic report on the basis of documents of primary accounting and submit under procedure set forth to territorial state statistics authorities.

The list of wastes for which state statistic accounting is executed is prepared by the Ministry of Natural resources in compliance with state classification code SC 005-96 "Wastes' Classification Code"⁹⁴ approved by State Statistic Committee.

Waste passports are prepared by the companies in order to fully identify the wastes and define the best ways of their management. Waste certification includes process of sequential gathering, generalization and storing of information for each specific type of wastes, their origin, technical, physical and chemical, process, environmental, sanitary, economic and other parameters, methods of metering and control, process of gathering, transporting, processing, disposal, removal, neutralizing and burial.

Technical waste passport includes the following data:

- description, location, conditions and volumes of each waste type forming;
- technical, physical and chemical, process, environmental, economic and other waste parameters;
- methods of parameters monitoring, among other accounted impact factors;
- data on available and potential processing, storing, transporting, disposal and removal methods.

Structure, content, rules and sequence of wastes technical passport fill-in is set forth by the State Standard of Ukraine (SSU).⁹⁵

Control of primary accounting fulfilled in companies and waste certification shall be performed by State Environmental Inspection.

Besides, State Environmental Inspection shall execute state supervision (control) of adherence to laws on waste management and adherence to requirements of permits issued for waste management. It also supervises adherence to requirements of waste production and placement limits, norms of gathering, transporting, storing, processing, disposal, neutralizing, removal and burial of wastes.⁹⁶

Waste pits construction requirements

Standard of the State Geologic Service of Ukraine. "Environment protection. Environment protection measures during oil and gas well construction" defines requirements on wastes pits construction.⁹⁷

⁹³ The Order of State Statistics Service of Ukraine №328 dated 28.10.2013 "On Approval of Methodological Instructions on State Statistic Observations in Waste Management" http://www.ukrstat.gov.ua/metod_polog/metod_doc/2013/328/328_2013.htm. In 2015 the new form of statistic report # 1-Wastes "Waste Production and Management" will come into force in compliance with the Order of State Statistics Service of Ukraine № 243 dated 19.08.2014 "On Approval of Forms of State Statistic Observations in Environmental, Forestry and Hunting Industries" <http://www.vobu.com.ua/ukr/legislations/view/258>. Before 2010 statistic reports were filled in only for I-III hazard class wastes on the basis of the form of statistic observation 1-Hazardous Wastes "Report on production, processing and disposal of 1-3 hazard class wastes". See Instruction of filling in the form of State statistic observations 1-Hazardous Wastes "Report on production, processing and disposal of 1-3 hazard class wastes" approved by the Order of State Statistic Committee of Ukraine # 494 dated 24.10.2006 <http://zakon2.rada.gov.ua/laws/show/z1195-06>

⁹⁴ State Classification Code of Ukraine. Classification of wastes DK 005-96 approved by the Order of State Committee on Standardization of Ukraine # 89 dated 29.02.1996 <http://www.uazakon.com/big/text152/pg1.htm>

⁹⁵ SSU 2195-99. Environment protection. Waste management. Technical passport of the waste. Approved by the Order of State Statistic Committee of Ukraine # 167 dated 08.09.1999 and enforced by the Order of the State Statistic Committee of Ukraine # 97 dated 03.02.2000 (replacing SSU 2195-93 (GOST 17.0.0.05-93)).

⁹⁶ Decree of the President of Ukraine # 454/2011 dated 13.04.2011 "Regulations on State Environmental Inspection of Ukraine" <http://zakon1.rada.gov.ua/laws/show/454/2011>

⁹⁷ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

Structure of waste storage pits shall ensure separate gathering of cuttings, flow back water and waste water, products of well testing. Taking this into account the system of pits is constructed in two or three sections, like connecting vessels, interconnected by flow lines. The first section is meant for gathering flow back water and drilled out rock. The second and the third sections are meant for settling down circulation fluid filtrate, collecting process fluid and waste water.

Soil bundle not less than 0.5 m high shall be done around the pits.

Pit volume shall be calculated at well design stage based on calculation of drilling waste volumes.

Depth of pits depends on the level of ground water on a specific area and shall be not less than 3 meters.



Figure 11. Storage pit. Photo: Shell Company

As pits on drilling site are constructed maximum depth of groundwater horizons shall be taken into account. Distance between the pit and deepest groundwater reservoir shall be not less than 2 m. In case the distance between the bottom of the pit and the deepest groundwater horizon is less than 2 m, soil is moved to the drill site to ensure respective level of the normative pit bottom in relation to the deepest groundwater horizon. On areas where groundwater is close to surface (on swamps) pitless drilling shall be considered. The deepest groundwater horizon in the area where pits are located shall be defined by monitoring wells.

After pit construction is finalized the pits are equipped with filtration preventive screens. The type of hydro-insulated screen (soil, polyethylene tape, polymer-bitumen, colmation or colloid and chemical) depends on mechanic and chemical composition and filtration properties of soil (humidity, density, volumetric mass of wet soil, porosity, granular composition and filtration index).

Need to hydraulically isolate formation fluid pits is defined based on engineering and geologic survey performed. Filtration index of the screens shall be not more than 10^{-5} cm/sec.

Results of engineering and geologic survey shall be used during pit construction to improve the quality of coverage, increase of tightness and hardness of soil, prevent inflow of groundwater (in case they have big head) and reduce filtration losses of waste water.

Defining the index (speed) of filtration is needed to choose the best structure and type of filtration screen for sludge pits to comply with the requirements set forth in legal acts to prevent contamination of surface water horizons with toxic contaminating substances. Defining of

filtration index is performed by metering the volume of loss of the process fluid penetrating the cylinder soil sample.

As the filtration screen is selected requirements of SN&R 2.01.28 are taken into account. In compliance with the norms border values of filtration index shall not exceed the following:

- At storing soluble wastes of II, III class of hazard - 10^{-8} cm/sec;
- At storing insoluble wastes of II, III class of hazard - 10^{-7} cm/sec;
- At storing wastes of IV class of hazard - 10^{-5} cm/sec;

Filtration screen type	Filtration factor
Soil	less than 10^{-5} cm/sec
Polyethylene tapes	10^{-12} cm/sec
Polymer and bitumen	10^{-10} - 10^{-12} cm/sec
Colmation	10^{-4} - 10^{-6} cm/sec 10^{-7} - 10^{-9} cm/sec
Colloid-chemical	less than 10^{-5} cm/sec

Filtration screens made of low permeable tight shale soils are used in pits in case there are abundant shale soils available in construction area. They shall be characterized by low permeability and at the same time resistance to salts contained in liquid drilling wastes. Shales and loess soils correspond to these requirements and contain low amounts of water soluble salts and organic matters. Filtration index of chemical resistant soils shall not exceed 10^{-6} cm/sec. Thickness of low permeable layer of the screen shall provide integrity and tightness of its structure. For drilling pits up to 3 meters deep soil screens 0.15 to 0.30 m thick are rather reliable. After the shale screen is backfilled the surface of the pit shall be processed with potassium chloride and compacted. Research of filtration parameters of soil screens showed that filtration index does not exceed 10^{-5} cm/sec.

Polyethylene tape screens are put in sludge pits in cases when there are no shale soils suitable for screens in the drilling regions or when complications related to shale soil compaction are encountered and stipulated by landscape, climate or operational conditions. To make a filtration screen it is recommended to use stabilized polyethylene tape (density of not less than 0.92 g/cm³, breaking stretching stress of not less than 11 MPa, mean breaking elongation of 300% and allowable temperature range of minus 60°C up to + 80°C). As an underlying layer for polyethylene tape special fine sand 10-20 cm thick is used. Peculiarity of polyethylene tape screen is resistance to aggressive chemical components used to mix circulation fluid and low temperatures resistance.

Polymer-bitumen screens for sludge pits are used when pits are constructed in permeable rocks with filtration index of more than 10^{-5} cm/sec (pebbles and gravel filled in with coarse sand, coarse, medium and fine sands, fractured rocks) or when groundwater level is higher than 5 m. To make screens in sludge pits it is recommended to use hydro isolating polymer-bitumen materials aimed to insulate foundations, bridges and hydro technical structures, are used. Polymer-bitumen materials contain rot proof base (glass fabric, framed glass fabric, polyester) covered from both sides by modified polymer-bitumen binding substance. As an underlying layer for polymer-bitumen material special fine sand 20 cm thick is used. Peculiarities of polymer-bitumen screen are resistance to mechanic impacts, loads, stretching, moisture and aggressive chemical substances used to mix circulation fluids, biologic resistance (to spores and bacteria) and low temperature resistance.

Colmation screens made of surfactants and polymers are fabricated from hydrophobized silica organic substances and polyisobutylene.

Colloid chemical screens are made on the basis of water suspension of hydrolyzed polyacrylamide (HPAA) and bentonite clay. In screens of colloid chemical type stabilized HPAA partially penetrated soil layer and fills in filtration pores.

Works on covering sludge pits with respective type of screen is formalized in respective act approved by local bodies of the Ministry of Natural resources of Ukraine.

To control potential leaks sampling of underlying rocks is done once a quarter along the perimeter of pit soil bundle. COC and pH, salinity of water samples taken from soil samples are defined to analyze migration of contaminating substances of circulation fluid and waste water. Design and equipping of monitoring network, monitoring and laboratory control of groundwater quality and water samples taken from soil samples is performed by respective departments of state geologic enterprises, OJSC "Ukrnafta" and SC "Ukr gasvydobuvannya".

Pitless drilling

During pitless well drilling drill wastes shall be deactivated to be transported to disposal sites. Deactivation of wastes on disposal sites is allowed in case such sites are approved by the bodies of sanitary and epidemiological service and on condition there is a positive conclusion of state environmental expert review outlining possibility of such disposal.

To gather or remove the drill cuttings and waste water during pitless drilling, to clean drilling waste water and ensure reversed water supply block made of four metal tanks not less than 40 m³ each and drill cuttings container to collect drilled out rock are used. Tanks are installed in insulated pit and are inter-connected with flow lines in the top part. After one of these tanks is filled with the waste water the flow is sent to the other tank. At the same time water in the filled one is treated with coagulants. The aim of such treatment is to stimulate settling of mineral and organic contaminating matters which form suspension and achieve normative parameters of cleaned water allowing its use for irrigation or covering process needs of the drill rig. After settling the water with a mud pump is injected to the fourth tank and compacted settled substances are unloaded by the excavator to dump truck and removed from the drill site to special locations. Waste water is sent into the emptied tank and the cycle is repeated. Treated water from the fourth tanks by back pump is injected to flow back water tank to be used for process needs on the drill rig or transported to new drill rigs. Solid wastes (cuttings) collected in containers are periodically removed to special locations. After drilling is finished drill wastes are transported to special sites, the tanks are cleaned, dismantled and removed.

6. Requirements on hazardous substances management (drilling chemicals, hydrofracturing materials) and requirements on disclosure HF chemicals data.

During unconventional natural gas production, at well drilling stage and during hydrofracturing different chemical substances (corrosion inhibitors, biocide substances and friction reducing agents, etc.) Ukrainian laws set certain requirements on hazardous chemical substances management which shall be adhered to during natural gas production.



Figure 12. Guar gum and water gel. Photo from shell.ua web-site

Muds and chemicals of minimum toxicity level shall be applied during well drilling in compliance with the detailed design requirements. Western chemicals used in oil and gas wells drilling in Ukraine shall comply with norms and standard of environment protection adopted in Ukraine and shall have conformity certificate.

As circulation fluids and cement slurries are mixed and transported as well as at storing of chemicals, materials, petroleum products spills, dispersal and leaks of toxic substances on the plots allotted or access roads shall be avoided. Transporting of materials and chemicals in proper containers, and storing materials in closed premises (shelters). Materials, chemicals and other substances used to mix circulation fluids and cement slurries shall have proper documents specifying maximum allowable emission values for air, water and soil.⁹⁸

Economic entities carrying out activities using hazardous substances shall, prior to work start, define presence or possibility of forming or release of hazardous chemical substances in work areas.

Based on level of biologic impact hazardous substances are divided into four classes:

- 1st - extremely hazardous;
- 2nd - highly hazardous
- 3rd - averagely hazardous;
- 4th - low hazardous.

Criteria of substance classification based on hazard class are specified in table⁹⁹:

Name of	Safety class norm
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⁹⁸ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

⁹⁹ GOST 12.1.007-76. Hazardous substances. Classification and general safety rules.

parameter	1st	2nd	3rd	4th
Allowable border values (ABV) of hazardous substances in the work area air, mg/m ³	Less than 0.1	0.1-1.0	1.1-10.0	More than 10.0
Average fatal dose when consumed orally, mg/kg	Less than 15	15-150	151-5000	More than 5000
Average fatal dose when consumed through skin, mg/kg	Less than 100	100-500	501-2500	More than 2500
Average fatal air concentration, mg/m ³	Less than 500	500-5000	5001-50000	More than 50000
Index of potential inhalation toxicity	More than 300	300-30	29-3	Less than 3
Acute impact area	Less than 6.0	6.0-18.0	18.1-54.0	More than 54.0
Chronic impact area	More than 10.0	10.0-5.0	4.9-2.5	Less than 2.5

In case of availability or possibility of release of hazardous chemical substances the entity shall estimate hazard created by chemical substances based on:

- passports of the chemical safety passports for substances provided by person issuing the conclusion of the expert review performed by the State Mining Control of Ukraine authority to check adherence to normative and legal acts on labor protection, enforced in Ukraine and prepared under SSU GOST 30333:2009¹⁰⁰. It is also prepared based on conclusion of state sanitary and epidemiological expert review of properties and level of hazard of a chemical substance and safety measures needed, certificate of compliance issued for chemical in compliance with the Law of Ukraine "On Evidence of Conformity"¹⁰¹ and "On Standards, Technical Regulations and Procedure of Conformity Evaluation"¹⁰²;
- maximum allowable concentrations of hazardous substances in the work area air;
- information in measures carried out to ensure safety operations with chemical substances, especially based on previous (employment), periodic and preventive medical examinations of employees and results of work places attestation for labor conditions inspection.¹⁰³

For works related to use of hazardous chemical substances women and underage labour is prohibited. Hard works and works related with hazardous and unsafe labor conditions where women and underage labour is prohibited, include specifically cement truck operations, cement and sand mixers' operations, hydrofracturing operations, subsoil well work over operations and operations on chemical treatment of the wells, etc.^{104, 105}

As the works with hazardous chemical substances are performed the company shall provide collective protective equipment (fencing, isolation, etc.) and necessary PPE to its employees.

¹⁰⁰ SSU GOST 30333:2009. Passport of chemical product safety. General requirements (GOST 30333-2007, IDT) enforced by the order of State Consumption Standard # 376 dated 15.10.2009.

¹⁰¹ The Law of Ukraine "On Evidence of conformity" <http://zakon1.rada.gov.ua/laws/show/2406-14>

¹⁰² The Law of Ukraine "On Standards, technical Regulations and Conformity Assessment Procedures" <http://zakon4.rada.gov.ua/laws/show/3164-15>

¹⁰³ The Order of the Ministry of Emergencies № 627 dated 22.03.2012 "On Approval of the Requirements Set for the Employers and Related to Employees Protection from Hazardous Chemical Impact" <http://zakon4.rada.gov.ua/laws/show/z0521-12>

¹⁰⁴ The Order of the Ministry of Health of Ukraine # 256 dated 29.12.93 "On Approval of the List of Hard Works and Unsafe and Hazardous Work Conditions for which Women Labour is Prohibited" <http://zakon4.rada.gov.ua/laws/show/z0051-94>

¹⁰⁵ The Order of the Ministry of Health of Ukraine # 46 dated 29.12.93 "On Approval of the List of Hard Works and Unsafe and Hazardous Work Conditions for which Women Labour is Prohibited" <http://zakon4.rada.gov.ua/laws/show/z0051-94>

An entity shall carry out measures to avoid or reduce to minimum hazardous impact of chemical substances applying special devices for safe processing, storage, neutralizing, sanitation or moving across work area chemical substances and wastes containing such.

An entity shall provide marking of operational and storing premises, containers, pipelines and means of in-fence transport, aimed at storage or transporting of hazardous or chemical hazardous substances.¹⁰⁶

An entity also shall ensure informing an employee, against signature, on labor conditions and, additionally, on:

- results of employee's work place attestation;
- availability or possibility of release of hazardous and/or chemical hazardous substance in course of the work, level of hazard thereof for human health, maximum allowable concentration of such substances;
- change of parameters in case of process or work arrangement change;
- meaning of signs put on equipment, containers or pipelines;
- benefits and compensations provided for employee operation specified work place.

Safety regulations in oil and gas industry set certain requirements to hydrofracturing¹⁰⁷.

In compliance with requirements formation hydrofracturing shall be performed under supervision of responsible engineer in compliance with the plan approved by the company. During hydrofracturing employees shall not be closer than 20 m to the wellhead or discharge pipelines.

Areas for hydrofracturing trucks shall be respectively prepared and cleaned from alien objects hampering rig up of the trucks and installation of the pipelines. HF equipment and tanks shall be located not less than 10 meters away from wellhead and laid out in such way that the distance between the units would be not less than 1 meter and their cabins would not be oriented to wellhead.

Discharge manifold shall be equipped with safety and shut-off valves and liquids drain pipelines. Discharge lines shall have back valves installed.

After the WH is hooked up discharge lines shall be pressure tested at expected HF pressure with the reserve index of 1.5. To measure and record HF pressure wellhead equipment shall be equipped with recording pressure gauge and pressure indicator, installed within safety radius. Before disconnecting pipelines from wellhead its valves shall be closed, pressure in the pipelines shall be bled off to atmospheric. Use of packers is mandatory during HF in case HF pressure exceeds maximum allowable casing pressure.

Employees directly involved in work performance shall be provided with radios to synchronize, approve and supervise the works performed.

Ukrainian Laws do not provide any direct requirements for disclosure of content and volume of HF fluid or detailed data on chemical substances used.

¹⁰⁶ In compliance with [Technical regulation in safety signs and employees health protection](http://zakon4.rada.gov.ua/laws/show/1262-2009-%D0%BF), approved by the Decree of the Cabinet of Minister of Ukraine №1262 dated 25.11.2009 <http://zakon4.rada.gov.ua/laws/show/1262-2009-%D0%BF>

¹⁰⁷ Order of State Committee of Ukraine on Industrial Safety, Labour Protection and Mining Control # 95 dated 06.05.2008 «On Approval of Safety Regulations for Oil and Gas Production Industry in Ukraine" <http://zakon2.rada.gov.ua/laws/show/z0497-08/>

7. Requirements on radiation control during hydrocarbon production

Hydrocarbon production, namely, unconventional gas production, is related to operations at big depths where sources of ionizing radiation (natural radioactive substances) can be located. Subsoil radioactive substances can be exposed to surface with drill mud, drill wastes, HF fluid, produced hydrocarbons or water. Such natural radioactive substances can cumulate or settle on equipment or in wastes (cuttings, flow back water).

Taking into account the above mentioned and adhering to requirements on human and environment safety the companies shall establish radiation control during hydrocarbon production operations.

Radiation control during drilling and production of oil and gas wells shall be performed in compliance with the requirements of state sanitary rules "Key Sanitary Norms Ensuring Radiation Safety of Ukraine"¹⁰⁸.

State sanitary supervision ensuring radiation safety is performed by radiologic departments of State Sanitary and Epidemiological Service of Ukraine of the Ministry of Health of Ukraine.

In compliance with mentioned document oil and gas producers shall be referred to category II of the companies - entities using ionizing radiation sources (category is defined by the level of potential hazard for population). For companies and facilities referred to this category radiation impact is limited to sanitary protective zone. Size of sanitary protective zone is justified in design documents taking into account meteorological and hydrologic conditions of the area. Borders of sanitary protective zone (SPZ) at design stage are approved by departments of state sanitary and epidemiological service of Ukraine of the Ministry of Health of Ukraine.

Radiation control in SPZ is executed by respective safety departments of the company.

Practical activities carried out with the use of ionizing radiation sources (IRS) shall be performed in compliance with instructions on radiation safety, providing for:

- procedure of work performance, accounting, storing, issuance and transporting, gathering and removal of radioactive wastes, maintenance of operational premises;
- safety measures and PPE;
- measures on preventing, finding and eliminating radiation emergencies.
- radiation control and supervision.

Main provisions of the radiation safety instructions defining procedure of specific work performance shall be put in due prominence in the premise or on work place. Instructions on radiation safety shall be approved with state sanitary and epidemiological service of Ukraine of the Ministry of Health of Ukraine.

To perform works using ionizing radiation sources the company shall:

- receive sanitary passport;
- obtain license granting the right to perform works using ionizing radiation sources;
- ensure work permit procedures for works using ionizing radiation sources are implemented;
- prepare and fulfill technical, organizational, hygienic measures needed to ensure radiation protection of employees, population and physical protection of sources;
- appoint by the company order persons, from A category (employees permanently or temporary working with ionizing radiation sources), who will be performing the works with such sources and ensure their proper training and instructing, including training in radiation safety. Such training shall be periodically refreshed to improve qualification and ensure the needed level of competence;

¹⁰⁸ Order of the Ministry of Health of Ukraine №54 dated 02.02.2005 "On Approval of State Sanitary Regulations "Key Sanitary Norms Ensuring Radiation Safety of Ukraine" <http://zakon2.rada.gov.ua/laws/show/z0552-05/>

- appoint with the company orders person(s) responsible for radiation safety, accounting and storage of sources, gathering, storing and transfer of radioactive wastes for disposal, responsible for radiation control, preparation and fulfillment of employees training programs;
- develop internal procedures outlining responsibilities of the employees related to work with radiation sources;
- prepare and approve in state sanitary and epidemiological service of Ukraine of the Ministry of Health of Ukraine control levels for the company, PPE, instructions on radiation safety of the company, ERP, instruction for the employees for radiation emergency case and regulations on radiation safety department of the company (person or departments responsible for radiation control);
- inform bodies of state sanitary and epidemiological service of Ukraine of the Ministry of Health of Ukraine on all changes in activities, related to use of radiation sources, if such changes reduce or may reduce the level of existing radiation protection of employees and population as well as physical protection of radiation sources; approve new levels of radiation and physical protection;
- train, instruct and check knowledge of radiation safety, labor protection, operational sanitary and other rules and control adherence thereto on a permanent basis;
- hold extraordinary instructions and check of knowledge of the radiation safety rules in case nature or class of work performed with radiation sources has been changed;
- arrange timely medical examinations of A category employees;
- within defined terms, submit to territorial bodies of state sanitary and epidemiological service of Ukraine of the Ministry of Health of Ukraine annual reports on adherence to sanitary laws.

Sanitary passport is a form of permit of State Sanitary Epidemiological Service of Ministry of Health of Ukraine for works with IRS confirming adherence to sanitary laws requirements and ensuring radiation protection of employees in operational premises and on work places as well as IRS protection of population. Sanitary passport is issued by state sanitary epidemiological service of Ministry of Health of Ukraine which has radiologic department or group carrying out sanitary supervision in sphere of radiation safety. Sanitary passport validity period is defined therein and shall not exceed five years. State sanitary epidemiological service of Ministry of Health of Ukraine body which issued the Sanitary passport supervises and controls adherence of Sanitary Passport provisions related to the list of permitted works.

Licenses for ionizing radiation sources management are issued by State Nuclear Inspection of Ukraine.¹⁰⁹

Dosimeter control in the company is the basis of radiation safety status control at carrying out activities.

Dosimeter control program includes:

- types, scope and terms of control;
- list of needed radiometric and dosimeter devices, auxiliary equipment and technical requirements and instructions on operation thereof; stationary and periodic control equipment layout;
- control facilities, including premises in which control shall be executed and outside environment objects located inside SPZ;
- controlled parameters;
- check and allowable levels (special allowable levels) of parameters controlled;
- approved instruction and methodological documents constituting control basis;
- procedure of work permit issuance for employees (including job orders);

¹⁰⁹ Decree of the President of Ukraine "On Regulations on State Nuclear Control Inspection of Ukraine"
<http://zakon2.rada.gov.ua/laws/show/403/2011>

- procedure of dosing accounting and planning;
- set reporting forms specifying procedure of report submission to bodies of state sanitary and epidemiological service of the Ministry of Health of Ukraine;
- valid dosimeter control plan; special dosimeter control program;
- operational dosimeter control plan;
- emergency dosimeter control plan;
- system ensuring quality of dosimeter control;
- employees executing control measures.

Monitoring of radiation condition is a special form of control. It is a metering of intensity or emanation aimed at research, assessment, forecast of radiation status, revealing sanitary laws' breaches, development of measures preventing, eliminating or reducing potential negative ionizing radiation impact on human (population) health.

To control quality and scopes of monitoring, create data bases and inform executive authorities of all levels, NGOs and citizens on radiation environment and exposure doses in different living conditions, as well as to ensure timely response to revealed breaches of sanitary laws, all companies, organizations and institutions involved in monitoring shall provide metering data to territorial bodies of state sanitary and epidemiological service of the Ministry of Health of Ukraine on a monthly basis upon request.

In case increased radioactive parameters of cuttings are observed during drilling companies engaged in exploration, appraisal or development of oil and gas fields shall notify, under procedure set forth, bodies of State Committee of natural Resources of Ukraine, Ministry of Environment of Ukraine and bodies of state sanitary supervision. Such notification is aimed at carrying out measures needed to ensure radiation safety.¹¹⁰

In event any involved company, including state control services, reveals a breach of sanitary law (exceeding hygienic norms) a notification shall be sent to territorial bodies of State Sanitary and Epidemiological Service of the Ministry of Health of Ukraine allowing them assessing situation, preparing recommendations on radiation conditions improvement and carrying out measures aimed at stopping the breach of sanitary laws.

All samples analyzed which do not require special storing conditions (soil, ashes, water and filters) shall be kept in laboratory of the company which carried out radiation monitoring for not less than 2 months after results have been sent to territorial bodies of state sanitary and epidemiological service of the Ministry of Health of Ukraine and if needed shall be transferred to it on demand for additional analysis (measurement). Records and logs, sampling protocols and metering results, or any other documents, confirming methodological, legal and other aspects of monitoring, its scopes and results, shall be kept for not less than 1 year and similarly provided upon request of state sanitary and epidemiological service of the Ministry of Health of Ukraine.

In case abnormal metering results are revealed (high intensity levels or unexpected radionuclides composition) samples and/or description of location where those were taken shall be immediately provided to territorial bodies of state sanitary and epidemiological service of the Ministry of Health of Ukraine. The latter shall:

- do additional metering on location where abnormal results or samples were obtained;
- assess metering results;
- investigate reasons of their origin under procedure set forth;
- if necessary provide recommendations on measures needed to improve radiation conditions in compliance with requirements of sanitary laws.

Required level of radiation protection of company employees is ensured by:

¹¹⁰ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

- radiation hygienic and organizational technical measures ensuring labor conditions complying with requirements of the current laws of Ukraine, norms of radiation safety and rules of radiation safety of Ukraine;
- limitation of IRS work access for persons depending on their age, gender and health; reliability of protective means, including factors regulating distance to the radiation source during work hours. Such limitations are imposed under procedures set forth;
- reliable and failure-free operations of structures, machinery, other means and systems ensuring low designed levels of probability of emergency caused by potentially emanating sources;
- system of preparation and support of high qualification of employees and adherence to requirements set for operations with radiation sources; ensuring availability of medical and preventing protective means;
- introducing radiation conditions alarm system;
- setting control levels;
- arrangement and carrying out radiation control corresponding regulations on radiation safety of Ukraine and other special sanitary rules;
- planning and carrying out effective measures on protection of employees in case or during radiation emergency.



Radiation protection of population shall be ensured through setting sanitary protective zones and control levels, as well as arranging and carrying out radiation control.

Equipment, containers, packing, transport means, devices, portable units and premises designated for operations with ionizing radiation sources shall be marked with radiation hazard signs.

Transporting radioactive wastes can be carried out by legal or physical entities which have obtained respective licenses under procedure legally set forth.¹¹¹ All transport means specially provided for permanent transportation of radioactive substances, including wastes, shall have sanitary passport.

Processing of radioactive wastes and their burial shall be performed by institutions specialized in radioactive wastes management.

Main institution of Ukraine performing gathering, transporting, conditioning and temporal storing of radioactive wastes is State Corporation "Ukrainian State Association "Radon". It includes SE "Centralized Company of Radioactive Waste Management", six special workshops (Dnipropetrovskiy, Donetsk, Kyivskiy, Lvivskiy, Odesskiy and Kharkivskiy), SE "Scientific Technical Center of Deactivation and Complex Radioactive Wastes, Substances and Ionizing Radiation Sources Management"¹¹²

Tubing and other equipment which was contaminated by radioactive substances of natural origin shall be deemed an intensive ionizing radiation source. Such tubing and other equipment upon approval of the bodies of sanitary and epidemiological service of respective regional administration of Ukraine can be temporary stored on oil and gas production industry facilities on specially equipped areas with solid cover. Access to such areas shall be prohibited to alien persons. Respective sign shall mark the area and subsequently tubing and equipment shall be transferred to specialized company for deactivation and recycling use or long term storage.

¹¹¹ The Law of Ukraine «On Radioactive Wastes Management" <http://zakon4.rada.gov.ua/laws/show/255/95-%D0%B2%D1%80/page>

¹¹²State Corporation "Ukrainian State Association "Radon" <http://www.radon.net.ua/>

8. Requirements on seismic monitoring during hydrocarbon production

In Ukraine system of seismic monitoring includes means of seismic and seismic forecast monitoring of the National Academy of Sciences, Ministry of Defense, State Committee of Urban Construction and Architecture, State Service of Geology and Subsoil, Hydrometeorologic Committee and National Space Agency.¹¹³

One of the tasks of seismic monitoring system is timely definition of location, time and parameters of earthquakes. To fulfill this task the Ministry of Emergencies and Protection of Population from Chernobyl Disaster Consequences of Ukraine provides the Cabinet of Ministers of Ukraine data on location and time of earthquakes with magnitude of 3 points and more expected on the territory of Ukraine and 6 points and more abroad.¹¹⁴

To collect data on seismic phenomena in Ukraine the National Data Center of Seismic Monitoring System has been established (unified center of informational and calculation department of S. I. Subbotin Geophysics Institute of the National Academy of Sciences and Informational department of Head Center of Special Control at National Space Agency).



Figure 13. Seismic stations network. Source: S. I. Subbotin Geophysical Institute, web-site: www.igh.kiev.ua

Regional and local seismic monitoring on the territory of Ukraine and highly accurate geodesic and geophysical monitoring in seismically active regions is performed by Geophysical Service of the National Academy of Sciences.

¹¹³ Decree of the Cabinet of Ministers of Ukraine №728 dated 11.09.1995 «On Establishing National Seismic Monitoring System and Enhancement of Safety of Population Residing in Seismic Hazardous Regions" <http://zakon2.rada.gov.ua/laws/show/728-95-%D0%BF>

¹¹⁴ The Decree of the Cabinet of Ministers of Ukraine №699 dated 28.06.1997 "On Approval of the Regulation on National Seismic Monitoring System and Enhancement of Safety of Population residing in Seismic Hazardous Regions, Regulation on Inter-department Commission on Seismic Monitoring and Program of Functioning and Development of National Seismic Monitoring System and Enhancement of Safety of Population Residing in Seismic Hazardous Regions" <http://zakon2.rada.gov.ua/laws/show/699-97-%D0%BF>

In S.I. Subbotin Geophysical Institute of National Academy of Sciences system including 36 seismic stations is operating. It actually performs a function of national seismic network. The network provides unified data on seismic phenomena on the territory of Ukraine on the basis of which expected levels of seismic hazard are scientifically justified. Those data are required by central and local authorities, scientific and research institutes of other Ministries and institutions, working in seismic design, construction and earthquake protection to ensure consistent development of seismic regions¹¹⁵.

The list of settlement of Ukraine located in seismic hazardous regions with the specified seismic intensity in points of MSK-64 scale for medium soils and three safety levels is specified in the SCN "Construction in Seismic Regions of Ukraine"¹¹⁶.

Ukrainian Law does not provide any specific requirements seismic monitoring during hydrocarbon, namely unconventional natural gas, production.

¹¹⁵The Decree of the Board of the National Academy of Sciences of Ukraine # 244 dated 08.10.2008 "Seismic Activity and Seismic Hazards in Ukraine" http://www1.nas.gov.ua/infrastructures/Legaltexts/nas/2008/regulations/OpenDocs/081008_244.pdf

¹¹⁶ Construction in seismic regions of Ukraine: DBN B.1.1-12:2006. - [Valid as of 02.01.2007] - K.: Ministry of Construction of Ukraine, 2006. - 84 pages. - (Ukrainian National Standard).

9. Soil reclamation requirements

The Law of Ukraine "On Soil Protection" provides that soils, the surface structure, environmental soil and source rock condition and hydrologic regime of which has been changed in course of mining, geologic exploration, construction or other works, are subject to soil reclamation.

Prior to work start on the land plot allotted for well drilling, borders of the plot shall be defined in-kind in compliance with requirements of the Land Code of Ukraine. Soil sampling to define quality and contamination level of fertile soil shall be done. Passport for the land plot on which oil and gas wells' drilling is expected shall be compiled.

During mining, exploration, construction or other works related to disturbance of soil, top layer shall be removed and bundled, stored and moved to disturbed or low productivity plots.

As the top fertile soil is removed in stages top layer being the most productive is bundled separately. Remaining soil layers are bundled depending on soil structure and source rock type.¹¹⁷

Reclamation of the disturbed soil is a set of organizational, technical and biologic measures aimed at restoration of top soil and improvement of productivity of disturbed soil shall be performed.

Reclamation on land plots is performed by moving soil in layers to low productivity areas or areas without top soil mass. If needed source rock is also moved to provide the highest productivity of reclaimed soil¹¹⁸.

Soil reclamation at drill site is performed in compliance with soil reclamation design documents which are a part of general design documents package prepared for well construction. Soil reclamation design shall be approved with the land owner or user, regional land agency, environment protection authorities and sanitary and epidemiological bodies.

Disturbed soils of all categories as well as adjacent land plots which partially or fully lost productivity due to negative impact of disturbed soils are subject to reclamation.

Reclamation of disturbed land shall be performed in two subsequent stages: technical and biologic.¹¹⁹

After well drilling and testing is finished soil reclamation is performed in the following sequence¹²⁰:

- rig down and removal of drilling equipment and concrete elements (slabs, foundation blocks, etc.);
- break down of monolith concrete foundations, trays, pits and removal thereof. Respective locations shall be filled in with soil and leveled;
- cleaning land plot from metal scrap, electrodes, grounding wires, construction wastes, remains of chemicals and other materials;
- cleaning of drilling waste waters, deactivation and neutralizing of circulation fluid and drill sludge;
- removal, deactivation and burial of top soil in a sludge pit in case soil is contaminated with oil or chemicals;
- backfill sludge pits with mineral soil (in proportion between soil and deactivated circulation fluid left after pit removal shall be 1/2 for wet soils and 1/3 for dry soils);
- removal of drill wastes in case of pitless drilling, cleaning sludge tanks, rigging down and removal thereof;

¹¹⁷ The Law of Ukraine "On Land Protection" <http://zakon4.rada.gov.ua/laws/show/962-15/>

¹¹⁸ The Land Code of Ukraine <http://zakon3.rada.gov.ua/laws/show/2768-14/>

¹¹⁹ GOST 17.5.3.04-83. Environment protection. Soils. General requirements on soil reclamation.

¹²⁰ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

- laying out surface on the area where top soil has been removed;
- carrying out measures on finding and removal of incidentally left metal scrap and other alien objects after mineral soil has been back filled and leveled;
- backfilling fertile soil on the area it has been removed from;
- soil reclamation on the areas occupied by temporary roads or transferring thereof to land user or land owner in compliance with conditions agreed.

After technical soil reclamation is finished quality and contamination level parameters shall be defined and agricultural-chemical passport for the land plot shall be compiled. This document shall provide data on agricultural-chemical soil properties and level of toxic and radioactive contamination thereof.¹²¹

Control results shall be attached to documents prepared to transfer the reclaimed soil to land owners or users.

Reclamation of the land plot shall be performed within a month after well testing or completion, excluding soil freezing period. In case reclamation works cannot be performed within a prescribed term due to climate or other conditions, reclamation plan and terms of its performance shall be determined in supplementary agreement between the drilling contractor and land owner (user) taking into account that defined term shall not exceed one year from drilling or testing finalization.¹²²

Biologic reclamation stage shall be performed by the land owner (user) and funded from well drilling costs outlined in design and estimate documents for the well.

Duration of biologic reclamation depends on soil and climate conditions, peculiarities of technical reclamation (thickness of fertile soil backfilled), level and nature of land plot contamination and efficiency of biologic reclamation measures.

Depending on post-reclamation land designation (agriculture, forestry, recreational facilities) additional requirements for reclamation can be set forth¹²³.

Soil users to whom reclaimed land is transferred for further use in agriculture or forestry shall ensure qualitative restoration of fertility (fertilizing, lime treatment, soil treatment, sowing crops, etc.) in compliance with the design approved. Timely household start of the land use shall be ensured.

Transfer-acceptance of reclaimed land and preparation of respective act shall be done by the commission appointed by local self-government bodies (if the land plot is located inside settlement) or local executive authorities (if land plot is located outside settlement).

¹²¹ The Order of the Ministry of Agricultural Policy №536 dated 11.10.2011 «On Approval of Procedure of Maintaining Agrochemical Passport for the Land Plots" <http://zakon4.rada.gov.ua/laws/show/z1517-11>

¹²² SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

¹²³ GOST 17.5.3.04-83. Environment protection. Soils. General requirements to soil reclamation.

10. Requirements on elimination of emergencies on highly hazardous production facilities

Hydrocarbon production facilities, including those for unconventional gas are classified as increased hazard facilities.

Article 8 of the Law of Ukraine "On Increased Hazard Facilities" obliges economic entities to:

- carry out measures aimed to prevent emergencies, reduce and eliminate consequences thereof and protect people and environment from impacts thereof;
- inform executive authorities, local self-government bodies and population on emergency which occurred on hazardous facility and measures carried out to eliminate its consequences;
- ensure minimum possible risks during operations of hazardous facilities;
- adhere to requirements of the law and other normative and legal acts regulating operations on hazardous facilities.

During well drilling breach of technological processes which can lead to emergencies, especially those related to gas shows and open flow, shall be prevented.

In compliance with Ukrainian laws¹²⁴ Emergency Response Plans shall be developed for potentially hazardous companies and facilities on which there is a possibility of major blowouts of explosive and toxic substances, explosions and fires which can lead to destruction of buildings, structures, process equipment and hurting peoples and negatively impact environment.

Availability of ERP in the company is required by the Oil and Gas Industry of Ukraine Safety Rules¹²⁵.

Emergency Response Plan (oil, gas, formation water or mixture thereof, blowouts, spills, destruction of pits' soil bundles, etc.) shall include instructions on notification of respective company departments which shall be involved in emergency and its consequences elimination. It shall also include the list of needed means and located on each well (of well cluster for that matter) emergency reserve of deactivating agents, method of collecting and deactivation of contaminants on a land plot, in water sources, etc.¹²⁶

Purpose of emergency Response Plan is to plan actions (interaction) of the employees of the Company, special departments, population, central and local executive authorities and self-government bodies aimed at localization and elimination of emergencies and reducing impact of consequences thereof.

ERP consists of analytical part including analysis of hazards, potential emergencies and consequences thereof and practical part which regulated the procedure of interaction and actions of employees, special departments and population (if needed) in case of emergency.

Central executive authorities ensuring forming and implementing state civil protection, fire and industrial safety policy shall within 10 days after the Emergency Response Plan has been approved provide to mass-media data needed to ensure proper actions and behaviour of population in case of emergencies, described in the Plan.

¹²⁴ See The Law of Ukraine "On Increased Hazard Facilities" <http://zakon2.rada.gov.ua/laws/show/2245-14>, Decree of the Cabinet of Ministers of Ukraine №956 dated 11.07.2002 "On Identifying and Reporting Increased Hazard Objects" <http://zakon2.rada.gov.ua/laws/show/956-2002-%D0%BF>, Order of the Committee on Labour Safety Supervision of the Ministry of Labor and Social Policy of Ukraine №112 dated 17.06.99 «On Approval of Regulations on Emergency Response and Emergency Localization Plan" <http://zakon1.rada.gov.ua/laws/show/z0424-99> (the order has been deforced as of 06.11.2012 <http://dnop.gov.ua/index.php/uk/normativna-baza/roz-yasnennya-zakonodavstva/9908-roz-yasnennya-shchodo-rozrobki-planiv-lokalizatsiji-ta-likvidatsiji-avarijnikh-situatsij-i-avarij-plas>)

¹²⁵ Order of State Committee of Ukraine on Industrial Safety, Labour Protection and Mining Control # 95 dated 06.05.2008 «On Approval of Safety Regulations for Oil and Gas Production Industry in Ukraine" <http://zakon2.rada.gov.ua/laws/show/z0497-08/>

¹²⁶ SOU 73.1-41-11.00.01:2005. Standard of the State Geologic Service of Ukraine. Environment protection. Environment protective measures at oil and gas wells construction.

Information on hazardous facilities shall be public. Namely an economic entity shall provide to state authorities data on owned or possessed highly hazardous facilities and all emergencies, development of which led or could lead to accidents.

Central executive authority implementing state policy of civil defense, fire and industrial safety and state supervision (control) on environmental protection, shall ensure processing of information provided in compliance with law and its transfer to local executive authorities, economic entities and other interested parties. Such authority also shall inform population, under procedure set forth, on emergencies which occurred on highly hazardous facilities.

Legal or physical entities or their representatives shall have the right stipulated by law to obtain within not more than 30 days information on hazard which arose on the highly hazardous facility and threatens people and environment.

Investigation of emergencies shall be performed in compliance with Investigation and Accounting Procedure for Incidents, Professional Diseases and Operational Accidents¹²⁷.

In compliance with the laws of Ukraine "On Oil and Gas" accidental gas, oil or formation water blow outs elimination shall be performed by oil and gas subsoil users which perform oil and gas exploration or production drilling or development of oil and gas fields and operate subsurface has storages. Subsoil users shall conclude inspection, preventive and emergency response agreements with specialized departments engaged in elimination of open oil and gas flows.¹²⁸

Besides, Ukrainian laws¹²⁹ stipulate the following mandatory insurance related to hydrocarbon production: (1) civil responsibility insurance for economic entities reimbursing damage which can be incurred in course of fires and emergencies on highly hazardous facilities including fire hazardous facilities and facilities operations on which can lead to environment and sanitary epidemiological accidents; (2) civil responsibility insurance for investor being a party of Production Sharing Agreement for damage, among other, incurred by environment and people, unless other is stipulated by Agreement¹³⁰; (3) property risks insurance under Production Sharing Agreement in cases envisaged by the law of Ukraine "On Production Sharing Agreements"; (4) property risks insurance at commercial production of oil and gas fields in cases envisaged by the Law of Ukraine "On Oil and Gas". In case the subsoil user did not conclude insurance agreement which is deemed mandatory under Ukrainian laws, this may be taken as a valid reason for special permit on subsoil use canceling or termination of Production Sharing Agreement. In such case losses incurred shall be reimbursed and simultaneous suspension (or none) of works stipulated by the Agreement may be applied¹³¹.

¹²⁷ Decree of the Cabinet of Minister of Ukraine # 1232 dated 30.11.12 "On Some questions of investigation and accounting of casualties, industrial diseases and accidents on production" <http://zakon2.rada.gov.ua/laws/show/1232-2011-%D0%BF>

¹²⁸ The Law of Ukraine "On Oil and Gas" <http://zakon2.rada.gov.ua/laws/show/2665-14/page2>

¹²⁹ The Law of Ukraine "On Insurance" <http://zakon4.rada.gov.ua/laws/show/85/96-%D0%B2%D1%80>

¹³⁰ Decree of the Cabinet of Ministers of Ukraine # 981 dated 13.11.2013 "On approval of Procedure and Regulations on Mandatory Civil Insurance of Investor's Liability, Including Liability for Damage Incurred to Environment and Human Health Stipulated by Production Sharing Agreement, Unless Other is Envisaged by Such" <http://zakon3.rada.gov.ua/laws/show/981-2013-%D0%BF>

¹³¹ The Law of Ukraine "On Production Sharing Agreements" <http://zakon2.rada.gov.ua/laws/show/1039-14>

Appendix. Schematic of permitting process in environment protection sphere

