

Slide 1

Accidents at industrial installations, prevention of their occurrence, impact on the Dnepr River

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Slide 2

Information. Water resources in Ukraine

There are approx. 63119 rivers in Ukraine, including the major ones - (total water surface of above exceeds 50 thousand km²) – 9 medium length ones (>d 2 d> 50 thousand km²) - 81 shorter ones (less to 2 thousand km²) - 63029. The total length of the rivers is 206.4 thousand km, but 90 % are short rivers. Water resources in Ukraine are formed by transit tributaries originating in other countries, local outflows and underground waters.

It is clear from long-term observations, that potential water resources of rivers constitute 209.8 km³, and only 25% originate in Ukraine, the remaining ones flow from Russia, Belarus, and Romania. Predicted resources of underground waters are 21 km³.

Approved usable underground water reserve is approximately 6 km³.

Slide 3

On 16 July 2009, an extended conference of the Ukrainian Ministry of Environmental Protection took place, on "Results of work at the Ministry in the first six months of 2009". **The issue of activation of work appeared among main issues intergovernmental arrangements related to cooperation in the area of trans-border of water reservoirs situated between Russia, Moldova, Romania, Belarus, Poland, Hungary and Slovakia, aimed at preventing the risk of accidents.**

Water protection - one of the most important areas of environment protection, confirmed by a number of Acts of the Ukrainian Parliament, and in the focus of political leaders.

The problem of protection against pollution which can occur as a result of industrial accidents in the vicinity of water reservoirs is tackled by Art. 14 «Principles of protection of surface water against pollution from industrial sewage ». The article postulates developing and implementation of emergency procedures in plants and factories which can be perpetrators of such accidents (such as: oil supply networks, products supplied by such networks, oil containers and oil related containers, containers of sewage, sewage collectors, waste processing plants, ships and watercrafts, oil derricks, drilling rigs), including plans of counteracting the effects of potential accidents. Such procedures should also list devices and areas which are under special protection against pollution (water sources, beaches etc.), the order of actions in case of an emergency situation, lists of the necessary technical equipment, methods of gathering and neutralising pollutants, as well as principles of using a polluted water reservoir.

Slide 4

Ecological map of Dniepropetrovsk Region

Slide 5

In 2004, in the town of Dniepropetrovsk, a project was developed on

„Technology transfer in protection of water reservoirs against effects of pollution from plants and technical installations in Romania, Moldova, and Ukraine (with part on the Dniepropetrovsk Region side)

- General results of the project
- In order to estimate the risk of influence on water reservoirs, and specify necessary measures, a number of companies were analysed
- a tyre factory
- a metal products factory
- a nitric acid manufacturing plant
- Catalogues of actions to be taken to prevent from industrial accidents were made for each of those companies: short-term, medium, and long-term (shared areas, storage and transshipping of liquids, plant fuel stations)

Slide 6

Below are examples of industrial accidents which happened between the end of 2008 and the beginning of 2009.

For example, on 27 June 2008, in the Dniepropetrovsk Region, in OAO «ДнепрАЗОТ», as a result of a breakage in a pipeline, there was an uncontrolled leak of 38 kg of ammonia. In accordance to the plant Emergency Situations Plan, steps were taken to locate the place of breakage, the effects were neutralized and minimised. There was no ammonia leak into water reservoirs.

Slide 7

Technological emergencies and accidents

Technological emergencies and accidents caused by a breach in technological procedures, were similar to disasters already in the 20s and 30s of the 20th century. Effects of such diseases often spread beyond national borders, and involved entire regions. Such unfavourable situation may have lasted for a few days or a few decades, and required involvement of large number of experts.

On the basis of analysis of consequences of a particular accident, following types of accidents and emergencies were named:

- accidents involving a leak of strong reacting substance (ammonia, chlorine, sulphuric and nitric acid, sulphur gas)
- accidents involving a leak of radioactive substances to the environment;
- fires and explosions;
- transportation crashes, etc.

Slide 8

Czarnobyl nuclear power plant accident in 1986

Very serious accidents may lead to disasters.

The most serious accidents in Ukraine was the Czarnobyl nuclear power plant accident in 1986

Because of a serious breach in technological procedures and errors, the year 1986 has become a year when humankind entered the era of nuclear disaster. History of humanity has not yet known an accident at such a scale, of unforeseen consequences and broad influence on populated areas. Irradiated soil, water reservoirs, towns and villages, influence radio-active nuclides on millions of people who live in the polluted territory for years, allows to name the scale of the accident global, and the situation itself as extraordinary.

Information: according to the experts' estimation, there was a leak of 50 megacurie of dangerous isotopes, and 50 megacurie of chemical, inert radio-active gases. The total radio-active pollution is equivalent to a fall of radioactive substances caused by the explosion of a few hundred A-bombs, similar to those which fell on Hiroshima. Soil, water and surface air were polluted as a result of this leak within the radius of a few hundred kilometres on the territory of Russia, Ukraine and Belarus, currently inhabited by around 5 million people.

Present radioactive status of the buildings of Czarnobyl nuclear power plant is as follows: radiation dose is 15-300 mP/year, and in several sections, it is 1-5 P/year. The envisaged time of operation of the sarcophagus protecting the reactor is 30 years.

Slide 9

Accident and emergency prevention

Nowadays, nobody is protected against consequences this or another accident in a nuclear power plant or. Even the distance of hundreds and thousands of kilometres is not a guarantee of total safety.

The issue of prevention against emergencies or accidents and neutralising their consequences is one of the most important for Ukraine

Chemical industry was developed rapidly after the Second World War in Ukraine, nuclear power plants were built, and unfortunately, non-ecological, environmentally harmful technologies had been introduced.

Irrespective of the quantity of projects implemented in order to increase the reliability industrial installations, it is impossible to completely eliminate a risk of technological accidents.

Plants and factories develop special procedures in order to minimise the consequences of such accidents, and reduce harmful influences on humans and natural environment.

Slide 10

Accidents in Ukraine

Around 140-150 technology-related accidents occur in Ukraine every day, both at local and domestic level. A rough structure of technology-related emergencies is as follows:

- fires and explosions - 19.5 %,
- transport crashes - 17.7 %,
- failures in council systems - 17.3 %,
- accidents in communal systems and waste processing plants - 17.3 %,
- accidents in other areas - 15.8 %.
- hazardous radioactive leaks - 8.4 %,
- hazardous substances leaking into the air - 4 %,

Annual losses as a result of such accidents have been estimated at 140-150 million hr. (\$20 million)

From the viewpoint of their influence on water installations in the recent period, the accidents did not occur in a plant or factory itself, but in the course of transportation of raw materials, materials, waste or sewage. let us analyse the chronicle of events from the previous year:

Slide 11

In the Dniepropetrovsk Region, a forest fire was extinguished in the area of Pawłograd, thanks to the assistance of Emergencies and Forest Management Ministry units.

- At 5 p.m., on 17 August, in the village of Wielikoaleksandrowka, the fire brigades which are part of Emergencies and Forest Management Ministry units extinguished a forest fire which started on 16 August in a pine forest belonging to a state owned forestry company, „Wielikoaleksandrowski Forestry”, on the area of approx. 70 ha (40 ha – top and 30 ha – bottom). Nobody was hurt.

Slide 12

A petrol cistern was overturned at an intersection in the town of Równo. Inlets opened in the cistern which was trailed, the other one was not damaged, Traffic was stopped, specialists from the Ministry of Emergencies closed the inlets, washed the petrol off the street, and covered with special foam to cool the petrol down.

Slide13

11.03.2008. Diesel oil spill in the merchant sea port of Mariupol

On 5 March, diesel oil contaminated the water in the merchant sea port of Mariupol. State Ecological Azov Sea inspectors assessed the situation and analysed sea water samples On location, the normal limits of concentration of diesel oil in sea water, were stated to be exceeded. Financial claim was made with respect to the owner of the vessel, “Svytoy Pavel” (under the Georgian flag, port of Batumi), charging them for environment pollution. The damage exceeded 90 thousand hr. The captain was given administrative punishment.

In accordance to the procedures of neutralisation, the staff of crew of the merchant sea port of Mariupol neutralised the pollution. Specialist vehicles worked all day and night, removing the absorbent with remains of diesel oil.

Slide 14

In Kercz, effects of an emergency in the Strait of Kercz are neutralised.

Brief notification on ecological disaster in the Crimea in 2007:

Due to bad weather at Black Sea and, in particular, in the Strait of Kercz., on 11 November 2007, four ships went 7 to 12 meters under water, three 6,5 thousand tonnage, carrying phosphor, one carrying mazout, approx. 4 thousand tons, one carrying scrap metal. Those were the ships:

- in the Strait of Kercz: "Волганефть-139", "Вольногорск", "Нахичевань", "Ковель", set at the depth of 7 to 12 meters
- In the area of Sevastopol, opposite Kozacza Buchta, "Hadzi Izmail" went under (scrap metal, under Georgian flag) at the depth of approx. 90 meters.

Slide 15

Sand and mazoute mix was deposited in the area of Kercz merchant sea port.

Two technological modules work at the yield of 120 ton/day, the third module is assembled, and will start work in the nearest future.

4 thousand tons of the mix was neutralised before June 2008

Slide 16

Collector damages

At 5.40 p.m., on 27 October 2008r, a 300 millimetre sewage collector cracked as a result of long-lasting operation in Mirnoje, and waste water filtered through to the soil. The collector served 60 homes, i.e., 3000 inhabitants. Specialised services were summoned to repair the damage, ecological inspection estimated the damage of polluting soil with sewage.

On 17 July, in Cherson, in Budionnego 20 street, as a result of heavy rains and breakage of the diameter 800 sewage collector, approx. 1000 cubic metres of unfiltered sewage found its way onto the surface.

Centralized water supply to 73000 inhabitants of the Suworow district of town was temporarily limited.

Repair work was done by specialist companies. The situation is under control of Central Regional Directorate of the Ministry of Emergencies.

Slide 17

Hydro technological installation breakdown

14 August 2008, in Adžaliksk Bay in the Odessa Region, as a result of mud contamination of a hydro technological installation connecting the bay with the Black Sea fish began to die on massive scale (171600 sticklebacks, 100 pelengas (Far East variety of cephal), and 135200 shrimps). Lab tests were done on fish, damages were found.

Water installation explosions

On 16 May 2008, in the Sumski region, at the Romny railway station, on the Bachmacz – Krzemieńczuk route, on a bridge over Suła River, train traffic was stopped. Ministry of Emergencies bomb disposal squad, divers from a special Emergency and Rescue Unit defused 2 antitank mines and one calibre 152 mm

Second World War artillery shell laying at the bottom of a water reservoir. Both were found by an amateur diver, who informed the Ministry about what he had seen. Following a close examination of the river bed, a decision was taken to neutralise both on location. Thanks to efficiency and skill of the special Ministry unit, the operation was successful, and caused no harm in the natural environment.

Slide 18

Explosions

About 4.15 p.m., on 27 August 2008r, in the Kharkov Region, in the town of Łozowa, in the uncovered area of the military unit of the Ministry of Defence, in the distance 4.5 km e north-east from the Łozowa railway station, ammunition exploded as a result of fire. Evacuation of soldiers and their family began about the 4.17 p.m., from the military fort.. Soldiers began to put out the fire on their own, however the Ministry of Emergencies fire-rescue units were called. 130 rescue workers, and 35 Ministry of Defence units took part in the operation, as well as 2 Ministry of Defence fire-fighting tanks. Necessary rescue units and special equipment were brought grew from neighbouring regions, including additional fire-fighting tanks. Special Ministry of Emergencies commission worked on location. The inhabitants were evacuated. Passenger trains departed in accordance with emergency timetable.

Slide 19

Fault in sewage cleaning installation

On 23 June 2009, the Kiev Region State Ecological Inspection inspected the Bortnicka aeration station OAO "Киевводоканал". In the course of inspection, which observed that the process of accumulation of surplus mud was faulty, a condition which could lead to an emergency.

On 21 June 2009 the Kiev Region State Ecological Inspection was informed by the Ministry of Emergencies, Borispol regional branch, that a dam around a mud island of filtration field №1 was broken. Inspectors on location saw that a dam around a mud island of filtration was broken, and as the result, the accumulated mud had overflowed. The fault was repaired, though the mud seeped into the soil over neatly 5 ha, and the soil became contaminated. The Ecological Inspection summed up the soil contamination damages.

Slide 20

Transportation accidents

On 3 June 2009 in the evening, between railway stations of Kryżopol and Rudnica, in the Pieszczański region, as a result of washing away of the railway track embankment 22 cargo train cars were derailed after a heavy rain. Among the overturned cars were:

- 5 cisterns with mineral oil, with one beyond the track near the forest. The area of spillage was around 100m². Oil is seeping onto the track from the remaining cars.
- 7 car with «Azofoska» mineral fertilizer in 50 kg paper sacks. About 100 of sacks were depressurised. Carriages are on track.

Remaining cars were loaded with metal smelting raw materials and timber.

Reconstruction work is done on location, State Inspection experts have taken soil and mineral oil samples in order to estimate losses. The situation under control of the Inspection.

Slide 21

Categories of emergencies and industrial accidents according to types, June 2009.

- Sudden destruction of buildings and structures
- Transportation accidents
- Municipal systems breakdowns
- Fires, explosions

Slide 22

Quantification of emergencies in Ukraine in June 2009, according to classes and regions

Classifications of emergencies and industrial accidents

Natural disaster

Industrial accident

Other emergencies

- Intensity of colour on the map reflects the number of emergencies in the region.

Slide 23

Forced, emergency water drainage in Western Donbas collieries

Each year, 25 million m³ highly mineralised colliery water is let out to the River Samara, and downstream to Dniepr River, from West-Donbas collieries (a group of 13 collieries). Approved drainage takes place in the autumn and winter.

Colliery water is initially mechanically cleaned from substances in cleansing ponds.

In part, colliery water is re-used to dampen fine coal dust and for other purposes.

The first stage of cleansing takes place in sedimentation tanks. The tanks had been damaged.

At various stages of the technology of colliery water cleansing and drainage, there are emergency outlets – overflows (in intermediary containers, pumping stations, and so on). Such outlets are called forced emergency outlets. Ecological Inspection estimates a damage, and a colliery pays for soil and hydrological installations pollution.

Slide 24

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Slide 25

Soil wash-out as a result of emergency drainage of colliery water

Slide 26

Colliery water drainage in Kośminaja Gorge, V-6 million M3, M-3-4 g/l

Slide 27

Swidowok colliery water reservoir, v-5,3 million m3, M- 5-6 g/l

Slide 28

Influence of waste drainage to the Dniepr River by Dniepropietrowska company

The biggest pollutants of the Dnepr River within Dniepropietrowsk city limits are: «Днепрводоканал» communal waste management company, and Dniepropietrowsk Metallurgy Plant.

Let us take a look at waste water drainage in Dniepropietrowsk Metallurgy Plant.

About 82 million cubic meters of waste water, practically not cleaned beforehand, is let straight into Dniepr River.

The amount of waste dumped into the river is 2,7 thousand tons per year

In the last 3 years, thanks to management improvements, the amount has been reduced by 30%.

The company is granted annual pollution limits, where waste is dumped with sewage. The company pays tax for polluting the environment. If the company exceeds the limit, it pays ten times of the normal tax.

Thanks to limitation of the quantity and reducing the limit to, practically best indices, negative influence of the company on water quality object is decreasing.

The company looks for new ways of reducing quantity of pollution. Zero limit should be final effect of actions taken towards protection of water, where the composition of the sewage mirrors the concentration of drained substances naturally present in the river. Even in case of a breakdown of a waste collector, the negative effect of sewage drained to the Dniepr is minimal.

The way it is done in practice is, that at a given stage of drainage canal on company premises, a waste processing container is built, whose tasks is to decrease the concentration of ferrous deposits in water, partly organic fertilizers and salt.

Slide 29

Emergency waste drainage in metallurgy and pipes manufacturing plants in Dniepropietrowsk

Slide 30

Waste drainage in metallurgy and pipes manufacturing plants in Dniepropietrowsk today

Slide 31

Waste processing installations (sedimentation) in w Dniepropietrowsk

Slide 32

Sewage processed by municipal processing plant (Central Aeration Station) before it is drained into the Dniepr River, Dniepropietrowsk

Slide 33

Conclusions

In order to minimise the effects of industrial accidents on general public and nature, companies are obliged to develop special procedures, in case such emergencies should occur, and to take into account the location and manner of neutralisation of such water pollution.

One of the basic measures to be taken in order to prevent industrial accidents is not only to prevent accidents themselves, but to secure ecological safety in keeping with rationally conceived operation of an industrial company.

Such a task can be achieved only in some cases, for example industrial waste disposal requirements should make the waste content comparable, or mirror natural composition of water into which the waste water is drained.

In other words, a company should make sure that waste water is cleaned from chemicals, hazardous biological substances and toxins in an extent so that it mirrors the natural composition of water into which the waste water is drained. (Photo)