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Enabling Ukrainian higher education to ensure a sustainable and robust reconstruction of (post-war) Ukraine

Practice session

BUSINESS GAME "SOLVING AN ENVIRONMENTAL AND SOCIO-ECONOMIC PROBLEM"

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Purpose and objectives:

Objective: to consolidate the knowledge gained in the lectures.

Condition: a public environmental organization and residents of the city district, based on information about the unsatisfactory environmental activities of the enterprise, demand that representatives of the district and city authorities close it down.

Task: to make a choice of a solution to the environmental and socio-economic problem or to propose your own solution with the development of a plan for responding to the risks of danger to the life and health of employees of the working conditions at the enterprise.

Description of the situation

The enterprise is located in the central part of the city directly on the bank of a fairly large river of fishery importance. Residential buildings, a sports and recreation complex, a cultural and patriotic memorial, and a city recreation park are located in the sanitary protection zone and in the area affected by its emissions. The enterprise is the largest producer of special steel grades in the city and the country. Its products are widely used in machine building, pipe production, and the defense industry. Its products are in demand on the international market.

The company has a closed joint-stock company as its form of ownership. The company's financial position is satisfactory. The company pays taxes to the local and state budgets regularly and in full.

The company employs more than 6 thousand people.

Description of the situation

The company's environmental performance is characterized as unsatisfactory:

- gross emissions of harmful substances into the atmosphere exceed the established standard by 1.5 times;
- the deadline for achieving the maximum allowable emissions has expired 2 years ago;
- industrial wastewater is discharged into water bodies in excess of the existing standards, and the deadline for complete cessation of wastewater discharge into water bodies expired 5 years ago;
- only 4% of the company's solid industrial waste is recycled for reuse;
- the rest of the industrial waste is deposited at landfills, causing a negative impact on the state of the air, soil and groundwater.

The district of the city where the enterprise is located is a working one. The population is 200 thousand people. The plant's employees and their families make up about 15% of the total population.

Using their rights, public organizations and residents of the district demand the closure of the plant.

Description of the situation

Legislation, including the Constitution, enshrines a number of rights of citizens and public organizations to participate in discussions on environmental issues. Citizens can:

- participate in meetings, rallies, marches, pickets, demonstrations;
- submit petitions;
- organize and conduct referendums and public environmental assessments on the location, design, and reconstruction of enterprises;
- discuss plans and programs of any activity that may have any (direct or indirect) impact on the environment;
- to demand, in an administrative or judicial manner, the revocation of decisions on the location of environmentally harmful facilities;
- raise the issue of bringing to justice the guilty legal entities and individuals;
- file claims for compensation for damage to health and property caused by environmental violations.

Suggested solutions to the problem

Option 1. The enterprise is closed

The demands of public organizations and residents of the district are fully satisfied

Positive aspects of this decision:

- the flow of pollutants into the environment is stopped;
- the condition of the air and water in the river, which is in the area of the enterprise's influence, is improved;
- waste formation and transportation is stopped.

Suggested solutions to the problem

Option 1. The enterprise is closed

Negative aspects of this solution:

- loss of 6 thousand jobs (increasing unemployment, decreasing living standards);
- the legal entity responsible for eliminating the harmful effects of production activities on the environment is lost (it is unclear who will rehabilitate areas contaminated with industrial waste, restore the consumer properties of the industrial site territory and other environmental measures);
- economic ties between regional levels are disrupted, with the likelihood of job losses at the facilities receiving the products;
- the receipt of funds to local and state budgets is stopped;
- the allocation of funds for the maintenance of social and household infrastructure financed by the enterprise (“departmental” housing, a culture house, a sports complex, a factory polyclinic and a medical and sanitary unit, a network of preschool and school institutions, a specialized metallurgical college is stopped).

Suggested solutions to the problem

Option 2. The enterprise is not closed

The enterprise is provided with the opportunity to bring its production activities in line with the requirements of the legislation within 5 years under the following conditions:

- the state control body sets a limit on environmental use for the enterprise for 5 years, taking into account the implementation of the environmental program;
- the enterprise pays (from its profits) for the limit in the amount of 5 times, the funds are transferred to the extra-budgetary environmental fund and spent on compensation for environmental damage;
- the enterprise develops a program to reduce its environmental impact to the standard indicators, and guarantees the implementation of the program (through a collective agreement or other legally binding documents).

Suggested solutions to the problem

Option 2. The enterprise is not closed

Positive aspects of this solution :

- 6 thousand jobs are saved;
- interregional economic ties are maintained;
- the local and state budgets continue to receive funds;
- after 5 years, the environmental situation in the area of the enterprise's influence is normalized.

Suggested solutions to the problem

Option 2. The enterprise is not closed

Negative aspects of this solution:

- the enterprise continues to pollute the environment with excessive amounts of pollutants for 5 years;
- the salaries of the company's employees are reduced compared to the expected ones, in accordance with the profitability indicators, in proportion to the costs of implementing environmental protection measures;
- the enterprise may sell its amenity facilities, including part of the housing stock, a sports complex, a cultural center, etc.

Suggested solutions to the problem

Option 3. The enterprise is not closed

The enterprise is allowed to continue its production activities under the following conditions:

- the enterprise is not issued a limit on natural resource use;
- the company pays (out of its profits) for excessive use of natural resources in the amount of 25 times. The funds are transferred to an off-budget environmental fund and spent on implementing a program to reduce the enterprise's environmental impact;
- the enterprise develops a program to reduce its environmental impact to the standard values for 8 years, which will be implemented at the expense of the extra-budgetary environmental fund;
- the city administration organizes an environmental and economic assessment of the proposed program.

Suggested solutions to the problem

Option 3. The enterprise is not closed

Positive aspects of this solution:

- 6 thousand jobs are saved;
- interregional economic ties are maintained;
- the enterprise continues to receive funds to the local and state budgets;
- after 8 years, the enterprise meets the requirements of the standards and becomes profitable, which will improve the living standards of workers;
- it is possible to attract funds from other sources of financing (budget, investors, insurance funds, etc.).

Suggested solutions to the problem

Option 3. The enterprise is not closed

Negative aspects of this solution:

- the enterprise continues to pollute the environment with excessive amounts of pollutants for 8 years;
- the salaries of the enterprise's employees are reduced compared to the expected ones, in accordance with the profitability indicators, in proportion to the costs of implementing environmental protection measures;
- the funds accumulated in the extra-budgetary environmental fund are not spent on improving the environmental situation in the area of the enterprise's influence, landscaping and greening the area;
- the enterprise may sell social and cultural facilities, including part of the housing stock, a sports complex, a cultural center, etc.

Guidelines for conducting a business game

After the students have gotten the objectives and the task, the group is divided into subgroups according to the number of characters. In each subgroup, the trainer assigns:

- a representative of the city residents who demand the closure of the enterprise;
- a representative of a non-governmental organization;
- a representative of the state environmental protection agency;
- a representative of the head of the enterprise;
- a representative of the local government (city administration).

Each of the students assigned to the role chooses a support group from their subgroup. Each appointed representative is explained the task assigned to him/her according to his/her role in finding arguments for solving the problem.

Each subgroup selects one leader who ensures a constructive flow of discussion in the subgroup, formulates a solution with the help of the subgroup members and presents it at the general discussion of the results.

Guidelines for conducting a business game

Each participant of the business game, proposing an appropriate solution and (or) choosing a particular solution option, justifies his or her position.

To explain its decision, each subgroup must prepare a Hazard Risk Assessment Map for the enterprise under study and calculate the risk category of the enterprise in accordance with the decision option.

The discussion of the chosen solution in each subgroup ends with its presentation in writing, in the form of a “Protocol of Discussion of Environmental Problem Solving”, and is signed by all selected subgroup leaders. In order to record the opinion of each subgroup member, a sheet of “Results of individual solutions to the environmental problem” is filled out in the same time. The analysis of these results allows you to identify the impact of the virtual position held by each participant in the business game on their decision-making.

The subgroup or each of its members may adopt their own alternative solution to the problem (provided that this solution is explained).

Development of a Risk Assessment Map

Risk level modeling

Risk assessment is carried out by:

$$R = S \cdot E \cdot P,$$

where R - risk; S - expected damage; E - exposure time, hazard exposure; P - protection from hazard; P - probability of hazard.

Expected damage (S)

Cost	Losses	Amount of losses	
		Human losses	Material losses
100	The great catastrophe	Many fatalities	More than 10 million UAH
40	Catastrophe	Several fatalities	1—10 million UAH
15	A bigger catastrophe	A fatal accident	100 тис. — 1 million UAH
7	Large	Severe injury	10— 100 thousand UAH
3	Medium	Temporary disability for work	1—10 thousand UAH
1	Small	Microtrauma	Up to 1 thousand UAH

Exposure time, exposure of the employee to the hazard (E)

Cost	Duration
10	Permanent
6	Frequent (daily)
3	Sporadic (once a week)
2	Occasional (once a month)
1	Minimal (several times a year)
0,5	Disappearing (once a year)

Probability of hazard (P)

Cost	Value	Value, %
10	Very probable	50 (1 by 2)
6	Quite possibly	10 (1 by 10)
3	Hardly probable, but possible	1 (1 by 100)
1	Only sporadically possible	0,1 (1 by 1000)
0,5	It is possible to imagine	0,01 (1 by 10 000)
0,2	Practically impossible	0,001 (1 by 100 000)
0,1	Only theoretically possible	0,0001 (1 by 1 000 000)

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Hazard risk assessment map

NN	Scenarios of possible dangerous consequences	Cost of expected damage (S)	Exposure time, hazard exposure (E)	Probability of hazard exposure (P)	Risk assessment (R)

Risk categories

NN	Risk categories	Cost [R]	Necessary measures
1	Lowest	R< 20	No action is required
2	Low	20≤R<70	You should pay attention to
3	Medium	70≤R<200	Measures required
4	High	200≤R< 400	Immediate action required
5	Very high	R ≥ 400	It is necessary to stop work

Risk management

Decision-making algorithm to ensure safety for a potentially dangerous object

1. **Spatial limitation of the hazard.** If hazard maps and inventory data are not available, potential hazard zones are determined by scientific data.
2. **Existing safety measures.** All existing safety measures (such as land use planning, engineering structures such as dams, special codes for buildings, warning alarm systems, contingency planning, etc.) are listed and evaluated for their effectiveness.
3. **Objects of potential impact.** Receptors of potential impact are identified and characterized.4. Scenario definition. To assess the risk, several scenarios should be defined. For example, three scenarios of a hazardous event(s) and three exposure scenarios (for each potential exposure object) are identified. These scenarios are described and their probabilities are determined.
4. **Expected losses.** At the last stage of the risk assessment, consequence scenarios are determined. Expected losses for potential receptors are estimated.

Maximum and minimum losses are estimated for two indicators of losses - material assets and fatal human losses. Graphical representation of risk assessment results (magnitude and characteristics) should be available for further analysis.

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Guidelines for conducting a business game

After signing the “Protocol for Discussion of Environmental Problem Solving”, all subgroups work in a brainstorming format to develop and complete a “Response Plan for the risks to the life and health of employees and residents of the city”.

Risk	Responsible	Prevention / response plan			
		Prevention / response strategy(avoidance / acceptance /minimization/transfer)	Risk prevention plan	Risk response plan in the event of a risk	Budget for risk management

The risk characterization is an integrated framework that combines the previous components of the analysis into a single picture of the event and determines the magnitude of the risk. The risk characterization includes a summary of the assumptions, scientifically based uncertainty, reliability and limitations of the analyses.

Thank you for your attention!