

# Development of a Methodological Approach to Assess Seismic Risk by the Example of a Plant HCC «AMMK»

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**KEY WORDS:** Seismic risk, threat, potential, human factor, emergencies, technological lines, vulnerability, loss.

It is known that seismic risk is a probabilistic measure of a seismic threat, established for a certain territory (object) in the form of possible losses for a given time. Seismic vulnerability is the property of an object to lose its ability to perform natural or specified functions as a result of damage during seismic actions.

HCC «AMMK» is the budget of the forming enterprise of Uzbekistan and the output of commodity output of the plant for 2016 amounted to 3,052.1 billion sums (Fig. 1). Plus, HCC «AMMK» is steadily increasing the production rate and over the last 8 years, the output growth is more than 50 percent (Fig. 2). The pace of reconstruction and renovation of the plant's production capacities is high,



Fig.1. Release of commodity production of HCC «AMMK» for 2016

implementation of 14 projects in accordance with the Resolution of first President of the Republic of Uzbekistan on 25.12.2015. No. PO-2458. The annual volume of capital investments is 607.5 billion sums [1]. With such volumes of output and capital investments, the plants potential for reducing its seismic risk must be very high for reliable achievement of the planned targets, because even if the plant, because of the possible seismic threat, reduces the volume of production by 10 percent, the amount of economic damage will be a huge amount. The probability of a seismic threat really exists, and it is due to the fact according to the map of seismic micro-zoning made in 2009 by scientists of the Institute of Seismology named after Mavlonov G. of the Academy of Sciences of Uzbekistan,

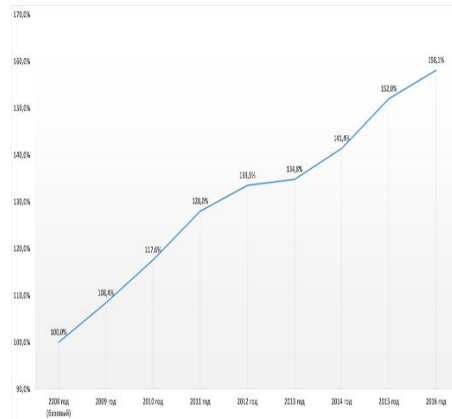


Figure 2. Dynamics of the volume of production of Housing construction cooperative and Almalyk mining metallurgical combine

The Almalyk region ( $\varphi = 4005030.23$  and  $\lambda = 690\ 3311.81$ ) is located in the zone with an earthquake intensity of 8 on the MSK scale. At this level of intensity of the earthquake, extensive and deep cracks are formed in the walls of the reflective, oxygen-flare furnaces, the ladle is moved to transport the fused copper ore, reaching several centimeters. Cracks in the ground lead to a weakening of the bearing structural elements of the buildings and structures of the technological line, enrichment and smelting of copper ore. The degree of seismic risk or the consequences of its seismic threat implementation depends on the potential of the enterprise.

The purpose of this work is to assess and enhance the potential at the "risky" sites of HCC «AMMK» and develop organizational, technical and social measures to reduce the degree of seismic risk. Potential is known to be a combination of all the forces and resources available to the organization that can reduce the degree of risk. Assessment and increased capacity will effectively manage risks on "risk" sites. An important component of the potential is the human factor, i.e. the readiness of the plant's personnel to perform their duties in emergency situations related to the earthquake. The willingness of personnel to work depends on the stable formations - knowledge, experience, abilities and mental state at a particular stage of activity, characterizing the state of the psyche at the moment. With this in mind, a questionnaire was conducted among engineers and technicians of the plant to assess the readiness potential of the HCC «AMMK» personnel to reduce seismic risk.

The results of the questionnaire survey of the engineering department of the HCC «AMMK» on issues related to the availability and scale of the seismic threat, possible consequences, medium and strong earthquakes for the production lines are processed, analyzed and listed in tables 1,2,3,4,5,6,7,8.

Table 1.

The composition of the survey participants from the number of engineers of Housing construction cooperative and Almalyk mining and metallurgical combine

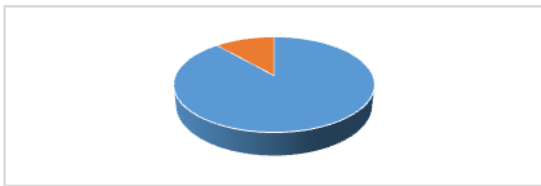
№	Education		B /%
1	Higher education		88,5
2	Secondary special		11,5

Table 2.

Survey results on the question "Do you know about the danger of an earthquake in Uzbekistan?"

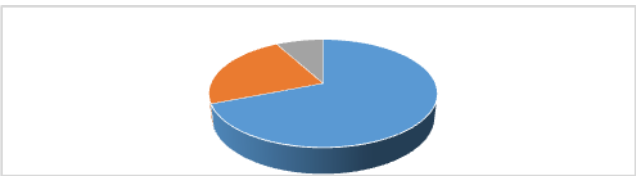
№	Answers		B /%
1	Know		69
2	Don not know		23
3	Both of them		8

Table 3.

The poll results on the question "Do you know about the danger of the earthquake in Almalyk?"

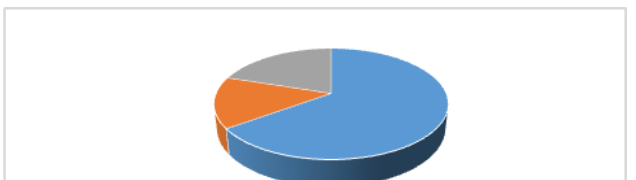
№	Answers		B %
1	Know		65
2	Don not know		15
3	Both of them		20

Table 4.

Survey results on the question "How does a strong earthquake affect the reliability of machines, equipment and technical systems of your equipment?"

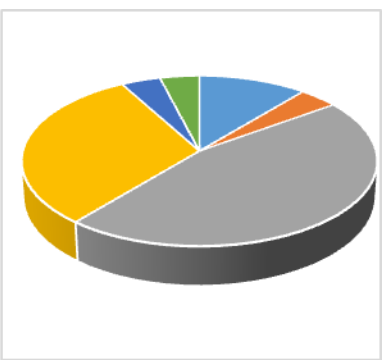
№	Answers		B %
1	Unplanned stops are possible		11
2	Destruction of ventilation systems of buildings and structures and a reflecting furnace		4
3	Negative		46
4	There is no danger		31
5	Catastrophic		4
6	Strong earthquakes lead to the destruction or disruption of individual nodes and constituent parts, the reliability of all technical systems of the facility		4

Table 5.

The survey results on the question "What heavy objects, products, machinery and equipment can overturn with possible earthquakes?"

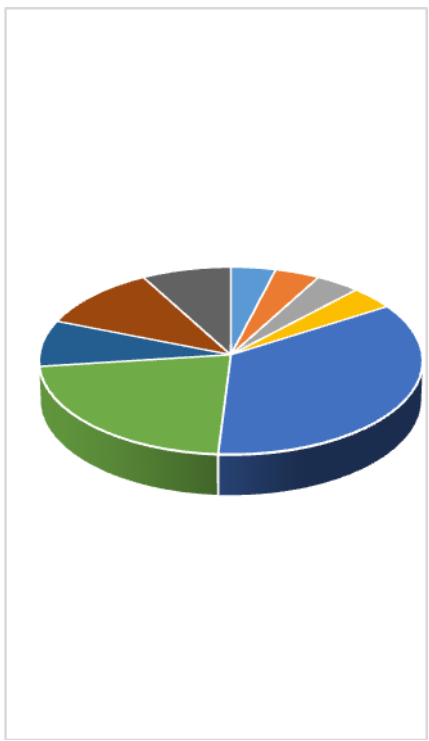
№	Answers		B %
1	Can break down the chipboard -5 M		4
2	Electrical simple over laplines		4
3	Overheadcranes, metalstructures		4
4	Converters, anode furnaces, sanitary pipes, chimneys, towers		
5	Technological kilns, blocks, reactors CRV, locomotives and wagons		4
6	Not available		35
7	Negative		22
8	Buildings and constructions		8
9	Office equipment and furniture are not securely attached		11
10	On the behavior of equipment and the shutdown of the technical process		8

Table 6.

Survey results on the question "What is the reason for the failure of technical systems and machines in the event of an earthquake?"

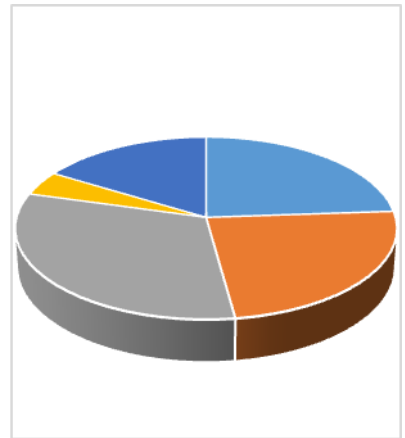
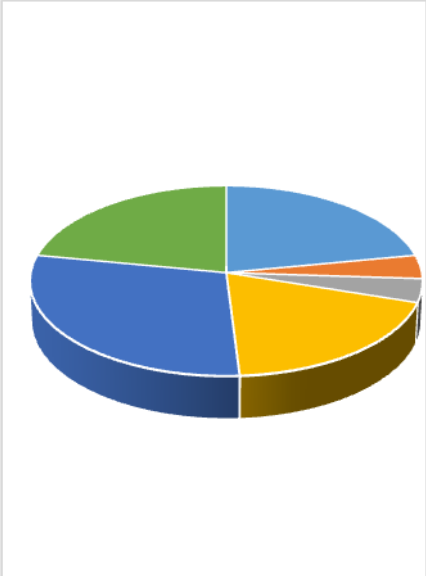
№	Answer		B %
1	Destruction of buildings and structures		22
2	Mechanical damage and power failure		22
3	Emergency situation		29
4	Vibration		4
5	The emergency shutdown or destruction of components and assemblies of the main technological devices is triggered by failure and stopping		15
6	I do not know	8	

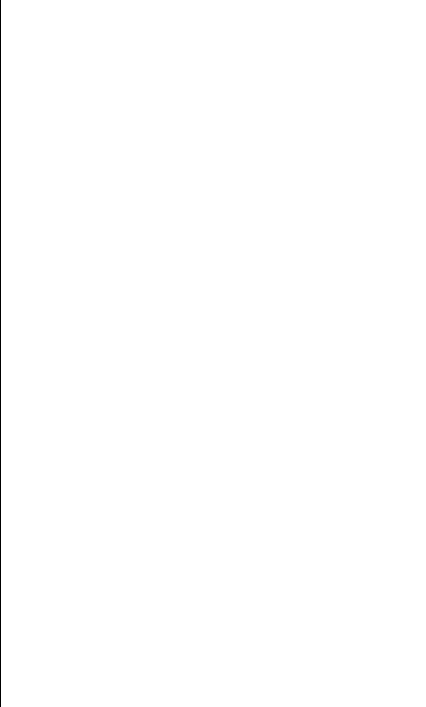
Table 7.

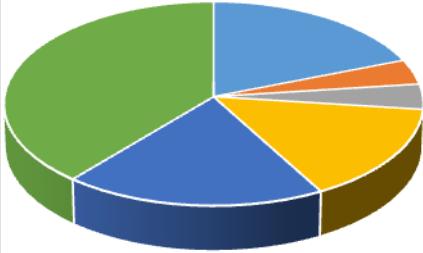
Results of a survey on the issue «What is the reason for the failure of technical systems and machines in the event of an earthquake?»

№	Answer		B %
1	Fires, explosions and emissions of harmful substances		
2	Disconnection for protection from the electrical network		22
3	The emergency shutdown or destruction of components and units of technical devices is triggered will lead to failure and stoppage		4
4	High Vibration		4
5	Incident and accident		19
6	Earthquakes lead to the destruction of buildings and structures		29
7	Quality of development		
8	I do not know		22

Tables 8.

The results of the poll on the question "If there is a breach of the tightness of the technical systems of your facility, there are dangers"?

№	Answer		B %
1	Fires, explosions, emissions of harmful substances and technical substances		19
2	Spilling HNO3		4
3	Destruction of buildings and structures failure of equipment		4
4	Tipping of the flotation agent tank of dangerous explosive solutions		15
5	The erection of brick, frame buildings from design to delivery		
6	The erection of frame panels, brick buildings and structures, to strengthen the seismic belt from planning to their delivery.		
7	Modernization and renovation of buildings and structures		
8	Destruction of buildings and structures		19

9	Do not know		39
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The results of the assessment shows the technological lines of production units and machine systems used in the enrichment of copper ore, copper production and other products have vulnerable sites and nodes that may lose operational reliability in the event of medium and strong earthquakes. 20-40 percent of respondents have low potential for seismic risk associated with seismic hazard.

To increase the capacity of «AMMK» to reduce seismic risk, it is necessary to assess the risk associated with seismic hazard, carry out preventive measures, monitor and forecast, and make management decisions to reduce seismic risk. Develop a targeted program to eliminate the consequences of the earthquake, provide assistance to the victims, organize rescue operations, provide medical, material, technical services, and foods.

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