Definition of basic violators for critically important objects using *the information probability method* and *cluster analysis*

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Abstract. Describes one of the approaches to the analysis of the ratios of the critical characteristics of the ski of important sites and typical violators with the use of information and probabilistic method. Objects and typical offenders are described by a set of General non-homogeneous characteristics. Information-probabilistic method was provided one-rodnost entropy potential characteristics of the training of offenders and the characteristics of the aftereffect of the actions of the offenders on the criterion of Pearson's Chi-squared and on this basis, characteristics of offenders, and critical facilities are kept in a common information field in a single six-point scales of measurement. Using the overall field of information and probabilistic method and the method of cluster analysis, obtained for each category of objects of the base type of the intruder. The results obtained can be used to determine the requirements for the physical protection of critical facilities.

1. Introduction

The analysis of the source [1] revealed that each secure facility has capacity of attraction, which is formed by the potential danger, in accordance with which builds the capacity of protection in the form of a physical protection system (PPS). In turn, each model the intruder has the potential danger, which is determined by the degree of its preparation. Thus, many typical offenders is having an impact on many kategoriyami objects in accordance with their potential. It is obvious that between the categories of critical objects (QUO) of the model and violators must exist a certain affinity, which is based on the total commensurability or the ratio of the characteristics of these sets (capabilities).

The author offers based on use of information and probabilistic method (IVM) and cluster analysis to determine typical base busters for each category QUO. According to the results of the model risk offenders to offer an appropriate level of protection (security) of objects.

Currently the problem of determining the underlying threats to the different categories of objects is mainly determined by expert methods [2], where there is an element of subjectivity, or on the basis of the theory of fuzzy logic and fuzzy hypergraphs [3].Recent methods do not allow us to estimate their weight contribution to the formation of the hazard potential of the object.

2. Statement of the problem

On the basis of processing the combined general information field of the characteristics of violators and categorized objects with the information-probability method and cluster analysis, it is necessary to determine for each category of CWOs of the corresponding typical violator.

3. Problem solving

To solve this problem, it is necessary to form a common information field in a unified scale for measuring the characteristics of violators and CVO.

To assess the potential danger of the object from the actions of violators, six private types of losses were introduced [4]: political; human financial; economic; environmental; informational. For each particular type of loss, one of the six scales of potential losses in case of an emergency (ES) was determined in the form of a six-point hazard scale, which are presented in table 1.

Table 1. The scale of potential losses in case of emergencies.

Indicators	Types of Emergencies					
	The local character	of the municipal character	of the intermunicipal character	of the regional character	of the interregional character	of the federal character
Injured people	no more than 10	no more than 50	no more than 50	more than 50, but no more than 500	over 50, but no more than 500	over 500
Size of property damage (million rubles)	no more than 0.1	no more than 5	no more than 5	more than 5, but not more than 500	more than 5, but not more than 500	more than 500
The scale of the partial losses of the six-point scale [1]	1	2	3	4	5	6

The results of the hazard assessment (attractiveness) for the seven categories of CVO in case of emergencies on a six-point scale, obtained in article [5], are shown in table 2.

Table 2. Characteristics of the consequences of emergencies at facilities on a six-point scale.

Private types of loss of objects	The scale of losses of categories of objects						
	1-cat	2-cat	3-cat	4-cat	5-cat	6-cat	7-cat
Political	5	4	4	3	2	2	1
Human	5	5	4	3	2	2	1
Financial	5	5	4	3	3	2	1
Economic	6	5	4	3	3	2	1
Environmental	6	5	4	4	3	2	2
Informational	6	5	5	4	3	2	2

The characteristics of typical violators are also determined by RF Government Decree N875 [6], which are summarized in table 3.

Table 3. Characteristics of typical violators.

Characteristics of violators	Type of violator					
	X_1	X_2	X_3	X_4	X_5	X_6
Number	5 – 20	3 – 5	1	1	1	1
The goal	of terror. Act	of terror. Act	of terror. Act	Theft	Theft	Theft, ter. Act
Consequences of the actions of the offender	federal, regional, territorial	Beyond the boundaries of the facility	Within the boundaries of the facility	Within the boundaries of the facility	Within the facility	Within the facility
The level of awareness	is the general level	average level of awareness	low level of awareness	low level of awareness	high level of awareness	high level of awareness
Melee and firearms weapons equipment	high probability	high probability	high probability	low probability	low probability	Armed
Level of training to overcome barriers, willingness to engage in battle	High level of training	High level of preparation	High level of preparation	Low level of preparation	Low level of preparation	medium level of preparation

To solve this problem, we describe violators and objects in a single scale of measurement of characteristics. Based on the data in table 3, a transition was made from qualitative to quantitative characteristics of violators, which are summarized in table 4.

For a comparative assessment of the danger potentials of violators, an IWM was used, which allows one to reduce the particular characteristics of the considered violators (objects) to a complex potential in the form of an entropy index [6]. For the data in Table 4, the entropy potential of each type of intruder was evaluated using an IVM. The results are presented in Figure 1.

In Table 5, the characteristics of the damage caused by typical violators of the CWO on the same six-point scale were formed in such a way that the entropy assessment of the potentials of preparation (danger) of violators coincided with the entropy assessment of the potentials of the consequences of the target implementation of violators. That is, the entropy estimates in Figures 1 and 2 are uniform according to the Pearson chi-square test.

Table 4. Quantitative characteristics of typical violators.

type narushitla	Characteristics of violators					
	Numbers	Objective of action	Consequences of actions	Level of information awareness	Cold steel, firearms (technical equipment)	Level of physical fitness
X_1	11	10	0.8780	0.7	0.9	1
X_2	4	9	0.5546	0.6	0.8	0.9
X_3	1	8	0.1731	0.4	0.7	0.8
X_4	1	2	0.0067	0.3	0.3	0.3
X_5	1	2	0.1158	0.9	0.3	0.3
X_6	1	5	0.1731	1	1	0.6

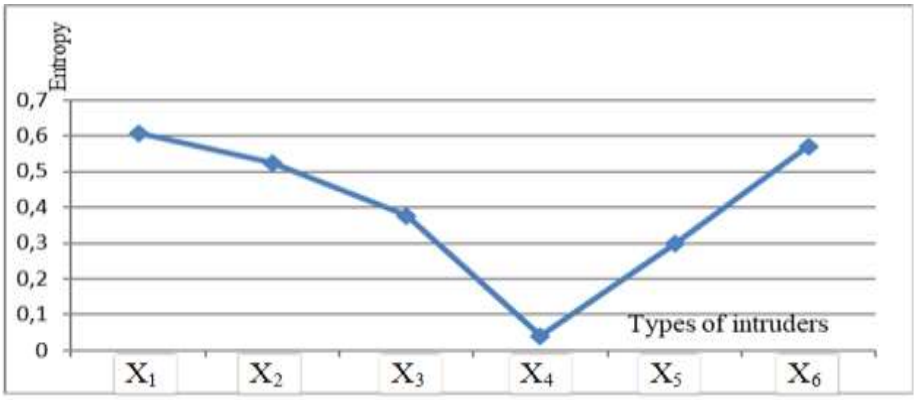

Figure 1. Entropic training potential of violators.

Table 5. Assessment of the consequences of the target implementation of violators with a six-point scale.

Private types of losses from the actions of violators	The scale of losses from the type of violator					
	X_1	X_2	X_3	X_4	X_5	X_6
Political	6	5	4	1	2	3
Human	6	5	4	1	2	3
Financial	3	2	2	3	5	4
Economic	6	5	4	2	2	3
Environmental	6	5	4	1	3	2
Informational	3	2	1	2	5	5

On this basis, information on violators and CWS (tables 2 and 5) should be combined into a single information field. As a result, we get table 6 with a common information field in a single measurement scale. In table 6, we replace the six-point scale with the entropy scale for the danger of emergency consequences, which was determined using the IWM to the data in table 1 [7] (H is the corre-

sponding entropy value of damage): 1 - local H = 0.007; 2 - local N = 0.116; 3 - territorial H = 0.173; 4 - regional N = 0.555; 5 - state N = 0.621; 6 - interstate H = 0.878. The transition from the six-point scale to the entropy hazard potentials is justified by the requirement to increase the reliability of the damage assessment scale [1].

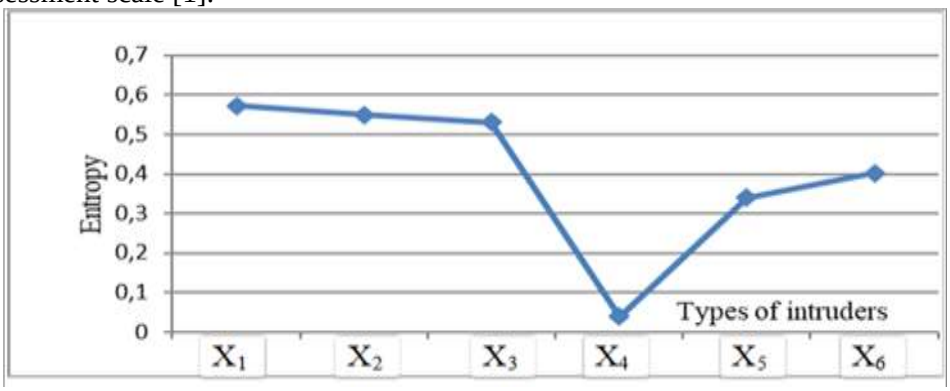

Figure 2. Entropy potentials of the target implementation of violators.

Table 6. Characteristics of categories of CIO and typical violators on the entropy scale.

Private types of losses	Typical violators and categories of objects												
	X_1	X_2	X_3	X_4	X_5	X_6	1-c	2-c	3-c	4-c	5-c	6-c	7-c
Political	.878	.621	.555	.007	.116	.173	.621	.555	.173	.173	.116	.116	.007
Human	.878	.621	.555	.007	.116	.173	.621	.555	.555	.173	.116	.116	.007
Financial	.173	.116	.116	.173	.621	.555	.621	.621	.555	.173	.116	.116	.007
Economic	.878	.621	.555	.116	.116	.173	.878	.621	.555	.173	.116	.116	.007
Environmental	.878	.621	.555	.007	.173	.116	.878	.621	.555	.173	.116	.116	.116
Information	.173	.116	.007	.116	.621	.621	.878	.621	.555	.173	.173	.116	.116
Entrop. potential	.633	.497	.446	.160	.368	.375	.733	.629	.547	.269	.219	.210	.122

Applying ICMs to the data in Table 6, we obtained the entropy potentials of typical intruders and categorized objects (shown in the bottom line of Table 6 and Fig. 3).

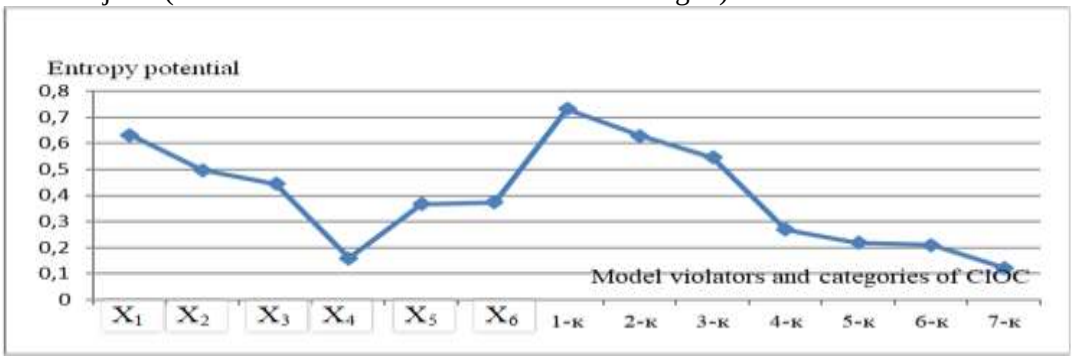

Figure 3. Graph of the entropy potential of the CIOC and typical violators.

Having solved the problem of combining homogeneous potentials into clusters using the Statistika SPP, we obtained the results of combining typical intruders and KVO in the category (Table 7).

For each potential of the intruder, you can put the corresponding potential of the object's protection - for example, the probability of a safe state of the object. Obviously, there should be a correspondence between the danger potential of a typical intruder and the degree of protection of the object.

If the function of changing the entropy potentials of the type of intruder is associated with the required probability of a safe state for the first type of intruder (the highest probability is the value of the probability of protection of 0.98), and the weakest type of intruder (the sensitivity of the detection sensor is 0.6), i.e. . comparable to each type of intruder the required value of the object's protection from its actions. The results are shown in table 7.

Table 7. Correspondence table of basic violators and categories of objects.

Typical offenders	Category CIO	Entropy danger H	probability of a safe condition
X_1+(X_5+X_6)	1 - is a category	0.733	0.98
X_1	2 - category	0.633	0.96
X_2	3 - category	0.497	0.93
X_3	3, 4– category	0.446	0.85
X_6	4, 5 - category	0.375	0.60
X_5	4, 5– category	0.368	0.64
X_4	5, 6, 7 - category	0.160	0.68

4. Conclusion

The basic typical violators for each category of CVOs are determined, which are shown in Table 7. The results of the probabilities of the safe state of categorized objects (Table 7) can be used to justify the requirements for the effectiveness of the PPS CVO.

5. References

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