

## **METHODS OF PHYSICAL PROTECTION OF AQUATORIES AND AIR SPACE OF A NUCLEAR FACILITY**

E.A. Shcheglova, E.A. Sukhanov, O.V. Selivanikova

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenin st. 30, 634050

E-mail: [eas81@tpu.ru](mailto:eas81@tpu.ru)

Nuclear material has always been an object of interest for terrorist organizations because of the high cost of nuclear material and the ability to use it to create an explosive device. When designing a physical protection system, it's necessary to consider the possibility of gaining access through the vulnerabilities of this protection. One of such weaknesses is the water part of the perimeter of a nuclear facility, since problems arise in observing the principle of equal strength [1].

Violators can gain unauthorized access to the object by entering underwater using diving equipment, and to coordinate their actions, violators can use a quadrocopter. At the design stage of creating a physical protection system, it's necessary to take this feature into account and equip the water part and the coastline of the perimeter.

On the water, the «Barrier» is used as a barrier and counteraction to small swimming facilities. To counteract underwater intruders, a «Barrier-BS» type fence is installed, which has a surface and underwater mesh type [2]. Also, on the approach to the underwater obstacle, sonar detection devices «Tral M» are installed [3]. To comply with the principle of equal strength, it is also necessary to equip the coastal part of the perimeter with active optoelectronic detection means and optoelectronic surveillance devices [4].

To exclude the possibility of reconnaissance using a quadrocopter, it's necessary to detect it on approach to the protected area and land at the intersection of this zone, equipping the perimeter of the protected zone with the «Stopdron Arsenal» complex. This complex includes an optical target detection unit, a target recognition unit, a directional signal interruption unit [5].

The above equipment and its correct location on the territory of the water area, coastlines and the perimeter of a nuclear facility allows to counteract violators, increasing the penetration time, and allowing timely detection of illegal actions.

### **REFERENCES**

1. Stepanov B.P., Annual A.V. Fundamentals of designing systems of physical protection of nuclear facilities: a training manual. – M.: Publisher: Tomsk Polytechnic University, 2009. – 118 p.
2. Complexes of engineering and technical means of protection of objects from the adjacent water areas [Electronic resource]. – Access mode: <http://tetis-ks.ru/catalog/227/1250/>. – 04/10/2020.
3. Hydroacoustic station of underwater protection "TralM" [Electronic resource]. – Access mode: <http://dsystems-ks.com.ua/>. – 04/15/2020.
4. Announcer optical-electronic linear security [Electronic resource]. – Access mode: <https://www.tinko.ru/catalog/product/205188/>. – 04/20/2020.
5. Protection against unmanned aerial vehicles [Electronic resource]. – Access mode: <http://stopdron.ru/>. .04 04/25/2020.