KEY APPROACHES TO CREATION OF HARBOR ENVIRONMENTAL SECURITY SYSTEM

Yana (Iana) Yu. Blinovskaya

Sea ports are characterized as objects of high environmental and industrial risks. Decision-making process for prevention and elimination of emergency situation requires significant amount of operational information, especially determination of the source of impact. That's why creation of an integrated comprehensive environmental monitoring system in ports is an important and urgent issue. The creation process of the harborage monitoring system includes overall assessment of administrative, regulatory, environmental, technical and technological aspects that will optimize the procedure of decision-making in emergency situations at ports and improve port ecological status.

Keywords: environmental security, environmental monitoring, marine port, prevention and elimination of emergencies, harborage monitoring system.

"The mankind must live within the carrying capacity of the Earth's ecosystems and there is no reasonable alternative." This slogan was declared at a sustainable development conference in the late twentieth century. Unfortunately, the environmental situation in certain regions of the world continues deteriorating; this is evident especially in the boundary areas i.e. coastal zones. Littorals possessing significant resources are attractive for economic activities and trade. However, the high density of economic entities and conflict of interests deteriorate the over all situation. In this regard, the port areas or harborages need special evaluation [1, 2].

Sea ports are traditionally characterized as major hazard areas in both production and environmental aspects. There are many examples of catastrophic accidents in the port areas of responsibility, so the issues

of environmental security are priority ones. Decision-making process for prevention and elimination of emergency situation requires a significant amount of operational information, especially determination of the source of impact, so the creation of integrated comprehensive environment monitoring in the ports is an important issue. Unfortunately, at present the monitoring efforts cover a limited number of parameters. Currently the assessments of the air space and bottom sediment are highly irregular. In general, the process of monitoring requires in-depth analysis of the coastal marine area peculiarities.

Comprehensive monitoring procedure requires careful preparatory phase including creation of the system that monitors the key factors-of-impact. And a production string must include all the main elements of the monitoring process from information collection and analysis to output system for a consumer's decision. Within the area of responsibility of a seaport there are numerous sources of impact, so lack of attention to all participants of port activity could lead to a drastic deterioration of all incoming information value.

To form the harborage monitoring system it is necessary to implement the following steps:

1. monitoring tasks determination for the seaport area of responsibility including:
   a. Surface waters (oil/ litter pollution, etc.).
   b. Air (pollution by hydrocarbons, coal dust, etc.).
   c. Bottom sediments (heavy metals/ organics contamination).
   d. Other parameters.
2. Incoming information requirements determination.
3. Monitoring network structure creation as well as operational procedures development including sampling frequency and observation principles.
4. Development of a data gathering system with consumer interface (using geographic information systems).
5. Creation of an information verification system to meet the original requirements and revise, if necessary, the monitoring system.
6. Organization of an interpretation system for the results of monitoring and decision-making.

A significant number of the sources of contamination in both water and air environments are recorded in port basin. Thus, the results of the

monitoring will depend on amount and quality of information. It must include sufficient detailed data about the space-time variability in the environment and pollutant indicators.

The density of different pollutants location in a port area of responsibility, insufficient development of purification systems of industrial and municipal wastewaters, active navigation lead to a significant deterioration of the ecological status of port water areas [3]. The port basins are depressed of persistent oil pollution, which is characterized by small and difficult-to-detect oil discharges into seawater all year round. It leads to pollutants accumulation and is the most significant in comparison with scale of volley pollution. The floating garbage is also characterized as mass pollution. Therefore, during development of the monitoring structure and its hardware the pollutants specific must be considered.

Monitoring system development will provide organization of spatial aspects of observations i.e. range of the observation point locations and monitoring program composition i.e. performances, timing, frequency of observation [4].

Under current guidelines the general requirements for the monitoring station locations are their representativeness and observation coverage of both polluted and relatively clean waters. For example, the requirements for the specific areas and monitoring station locations are determined by a set of the following conditions such as:

1. the nature of the required information (detailing);
2. Designation of the monitoring area (category of the water basin and its status);
3. Forms of information (timely pollution changes estimation, pollutants spatial spreading evaluation, pollution forecast);
4. Physiographic and hydro-geochemical conditions such as climate, surface currents, river flow, etc.

The existing traditional monitoring system which results in sampling, analysis and data interpretation neither covers all areas of impact, nor generates timely information on a water area environmental conditions. Therefore, to detect the most abundant pollutants, primarily oil and debris, a polarization videography method can be used. Due to the polarization peculiarities of various thicknesses oil film reflection

characteristics it can significantly improve the reliability of the oil spots detection and identification process.

For videography of the sea surface in low light and night time it is possible to use solid-state optical channel light intensifiers. Thus, a system of regular (periodic) and on-duty (operational) observations that allows to reveal the source of contamination in time and to decide on its localization and liquidation.

On-duty monitoring subsystem should provide:

a. water basin surveillance according to preset program;

b. image analysis, oil and garbage spots identification;

c. video recording and storing, and in case of contamination:

- a more detailed inspection of the contamination area and identification of the polluting source;
- assessment of the area of oil spot;
- the oil spot movement monitoring;
- ensuring self-control.

The following measures are necessary to create the on-duty monitoring subsystem:

1. Development of the permanent monitoring subsystem project, in which it is essential to evaluate quantity and locations of video surveillance devices for optimal cost-effective configuration.
2. Video surveillance equipment and communication lines development and installation.
3. Water area monitoring software development.
4. Ensuring of the operational observation subsystem operations.
5. Acquisition of appropriate equipment and software.

In recent years the surface contamination monitoring has also become popular. Based on remote sensing i.e. satellite imagery, aerial videography, it proposes two possible options for monitoring: “online”-with coordinate information remote transfer and “offline”–the information is taken upon arrival at the control point.

This method requires high-resolution images (not larger than 2.5 meters), equipment for decryption and interpretation or transmitting channel from a centralized source, the appropriate hardware and software as well as digital mapping information. No less important

is qualification and skills of personnel, which will provide more comprehensive data interpretation and summary results. The modern market of the remote sensing data has a significant database of images taken in different spectra, with a wide range of spatial resolution, coverage area, destination, etc.

To monitor port water basins in consideration with the specifics of contamination it is reasonable to combine different types of image acquisition. Thus, the radar images can detect an oil film of 50 microns on the water surface as well as get information regardless of weather conditions. The radar interferometry allows from the Earth orbit the detection of the surface deformation of an inch. The infrared band images deliver the data received in the dark.

Thus, the analysis of the existing systems shows reasonability of harborage monitoring activity consisting of two parts:

1. Routine (regular, periodic) monitoring of port basin pollution:
   - Obtaining of real information about water pollution in ports by the traditional monitoring means;
   - Use of remote sensing data for urgent information about behavior of oil spots and garbage fields;
   - Assessing of port basin clean up measures effectiveness.
2. On-duty (operational) surveillance of the port waters and for the potential sources of pollution:
   - Detection and determination of the main sources of pollution;
   - Registration of oil discharge and garbage dumping incidents;
   - Detection of pollutant concentrations and clarification of pollutants movement in order to plan treatment works.

Another important issue is the legal status of the waters. Analysis of regulations gives a reason to believe that there is a legal vacuum in the issues of pollution prevention procedures, water treatment and basin clean-up operations. The Federal Law № 7-FZ "On Environmental Protection" declared the responsibility of state bodies for environmental quality, but there is no clarification in funding sources and types of marine areas sanitary states inspections. Also the fundamental principle "the polluter pays" is violated and because of the constant shortage of funds the port basin cleaning system remains ineffective.

For the successful implementation of the program it is necessary to adopt measures at the Government level to transfer authorities for environmental programs implementation to the regional officials in the waters of sea ports located in their territories.

Thus, the solution of these issues will optimize the procedure for decision-making in emergency situations at ports and to improve its ecological status.

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