

# **Special features of development of documentation on environmental impact assessment for NPS dismantlement and remediation nuclear and radiation hazardous facilities**

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## **Introduction**

In the 80-ties of XXth century the problem of decommissioning and securing facilities of nuclear energy in safe condition for population and environment became the important issue in the countries with the developed nuclear power engineering. Now it is rather successfully solved. There was a separate direction of applied studies and practical projects for solution of this challenge concerning civil and military facilities [1]. The important feature of this process in the USA and France was that these countries have started decommissioning of military-purposed facilities having experience in decommissioning of nuclear power plants (NPP) and research reactors.

In Russia mass decommissioning of military-purposed facilities preceded the decommissioning of civil facilities, and the greatest number of decommissioned facilities was Nuclear Powered Submarines (NPS). From 1990 to 2000 under the guidance of the Ministry of Defense and the Ministry of Shipbuilding industry, and then under the guidance of the Federal Agency for Atomic Energy with wide involvement of research-and-development and design organizations, the system of preparation and performance of works on the complex dismantlement of NPS was created. This system had been reflected in the concept of dismantlement [2] and the state standard [3].

These documents determined the basic approaches and requirements for the documentation development and performance of works on dismantlement, including the unloading of spent nuclear fuel (SNF), securing a safe condition of reactor compartment units (RCU) as well as radioactive waste (RW) and toxic industrial waste (TIW) generated by dismantling process.

Resting on these documents Onega R&D Technological Bureau in collaboration with other leading Russian companies has developed packages of design, procedural documentation (PDPD) of the NPS dismantling. This PDPD was developed in compliance with Russian normative documentation and generally met the requirements of the international recommendations for safe dismantlement of ships and vessels [4-5] and SNF & RW management. This is confirmed by the independent consultant of donor countries which participated in solving of the problem of NPS dismantlement [6]. The evaluation and analysis an of NPS dismantling safety became important and integral part of PDPD that has provided safe performance of works on dismantlement for more than hundred NPS.

## **Features of development of documentation on substantiation of the personnel and environmental impact of NPS dismantling**

Preparation of a dismantlement of NPS and Ships requires the following documents:

- feasibility study (FS);
- NPS dismantling program;

- project of NPS transportation to the shipyard engaged in NPS dismantling;
- complete PDPD of NPS dismantling;
- documentation of NPS dismantling support .

The task of the FS development is comparison of technical, economic and ecological options of work and search for the optimal one that allows providing a process of NPS dismantling.

The purpose of development of NPS of dismantling program is the organization of the enterprise's production facilities to NPS dismantling, definition of dismantlement features of NPS of the given project at the enterprise, and also an establishment of the general and special requirements of NPS dismantling.

PDPD [7] contains the following information:

- «What do we have to do?» - the design documentation:
  - a)** Formation of the reactor compartment unit;
  - b)** Provision of NPS and NPP safety by SNF unloading;
- «How do we have to do that?» - the organizational and technological documentation:
  - a)** Technology and organization of dismantling at all stages;
  - b)** Necessity for manpower, material and energy resources;
  - c)** Technological equipment;
  - d)** Recycled materials and waste management;
- «Is it safe?» - the design documentation, organizational and technological documentation:
  - a)** NPP safety justification during SNF unloading;
  - b)** NPS safety justification by SNF unloading;
  - c)** Environmental impact assessment (EIA);
  - d)** Non-recycled materials and waste management;
  - e)** Requirements for radiation safety, health safety conditions safety, fire and industrial safety.

The important part of PDPD is the development of the document of environment impact assessment [8]. Development of this document is stipulated by the Federal Law #7-Φ3 of January 10, 1992 «About of Environment Protection » [9] for a kind of the planned industrial activities representing potential danger to the environment.

EIA is carried out for mitigation or prevention of negative influence of NPS dismantling to the environment and related social, economic and other consequences.

EIA identifies the following problems:

- identification of technological processes of NPS dismantlement which have potential negative environmental impact;
- forecasting of changes in environment, which can take place by NPS dismantling;

- forecasting of ecological and related social, economic and other consequences of NPS dismantling.

EIA basic principle is «Knowledge before action». So decisions should be applied on a basis of comprehensive knowledge of ecological consequences of activity, whenever possible at the earliest stages of its planning.

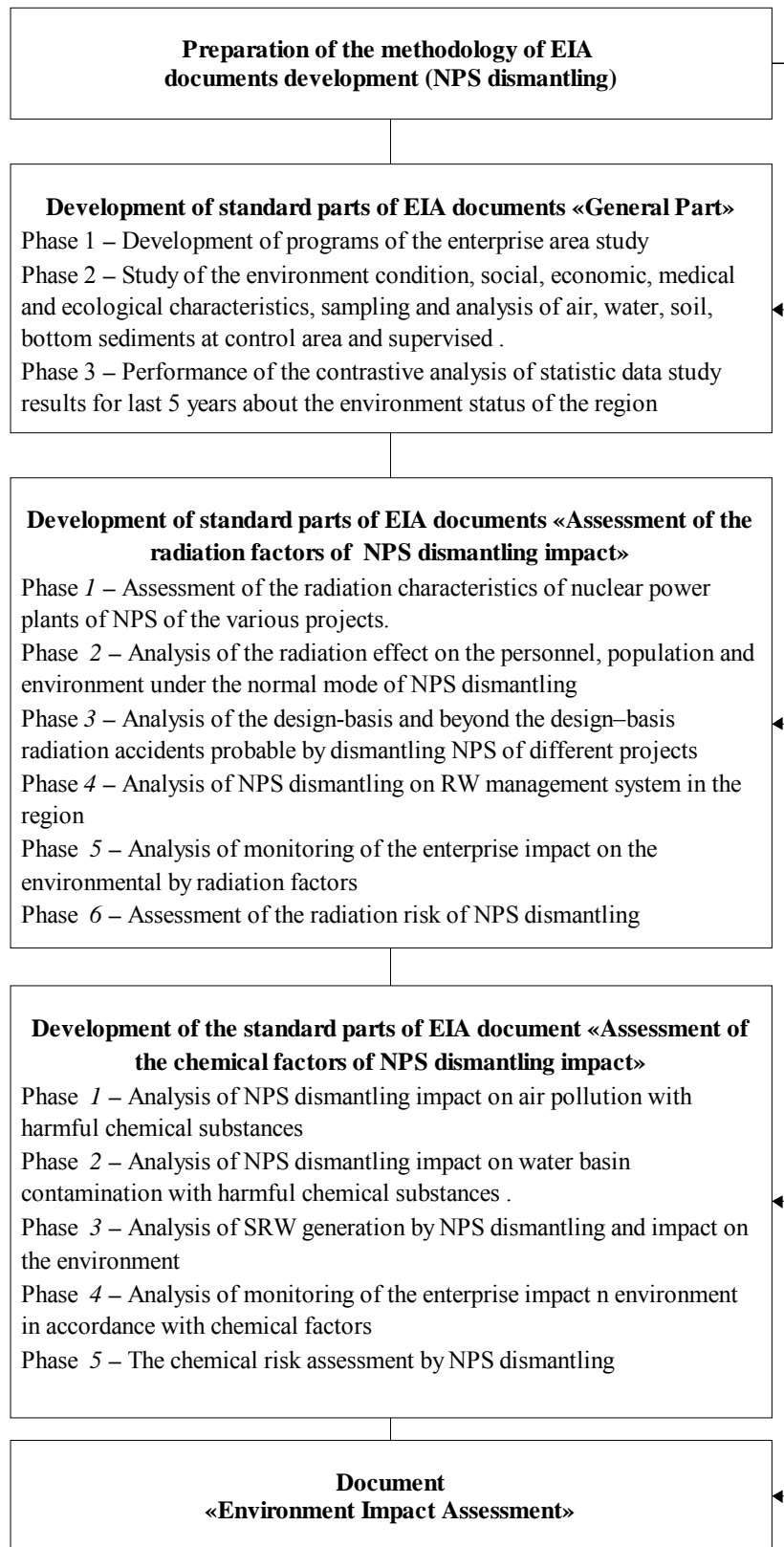
As a whole EIA will include the following elements:

- discovering of possible environmental impacts of planned activity and their negative consequences;
- inclusion of the actions on reduction of expected impacts in planned activity;
- analysis of profitability of planned activity;
- development of recommendations on monitoring;
- estimation and selection of alternatives;
- involving the public in decision-making process;
- taking EIA results into account.

It is necessary to note that the given order of performance of safety analysis and EIA carrying out is mainly focused on newly-designed facilities or production processes being developed. It is not quite right for the decommissioning projects associated with existing would-be-decommissioned (would-be-dismantled) facilities including the damaged ones. The basic differences are the following: the damaged facilities already pollutes environment and, as time goes by, the efficiency of safety barriers is reduced and the scale of pollution increases. Degradation of structures causes the increase of damage risk and negative environmental impact of single emissions.

Time required for development and implementation of the decommissioning and dismantling project is significant.

EIA means the decision of some tasks, which in their turn divide into several phases (see Figure 1).



**Figure 1 – Phases of EIA development**

By EIA carrying out not only technological processes and operations connected with process of NPS dismantling but also other industrial activity of the Shipyard are considered.

Russian EIA procedure includes two stages: EIA in the international understanding of this process, and the ecological examination of the documentation of planned activity.

At the first stage, EIA materials for inclusion in documentation are prepared.

The second stage is the ecological examination. The purposes of the ecological examination as a final stage of Russian EIA procedure include the following:

- To make sure, that the facility of the ecological examination meets ecological requirements and to determine the admissibility of its implementation from the ecological point of view;
- To prevent probable unfavorable ecological, social, economic and other consequences under the implementation of the project of ecological examination.

In 2006 the State Duma of the Russian Federation has brought some amendments in the nature protection legislation including the Federal law # 174-Φ3 dated November 23, 1995 « About Ecological Examination » [10].

Since 2007 the requirement of the obligatory state expert examination of projects of economic activities is cancelled. But the operational experience on joint EIA development under the international projects shows that it is necessary to lead up the information on planned potentially-dangerous activity to the public and the most convenient and effective means is public ecological examination in the form of public hearings.

### **The application of the experience of development of the documentation proving the environmental effect by NPS dismantling when developing projects of nuclear radiation hazardous sites remediation**

The experience of PDPD and EIA development of complex dismantlement of NPS is quite applicable to other similar projects.

In particular such approach has been successfully applied by "Aspect-conversion" when developing PDPD for the project of SNF unloading and Lepse Ship dismantling [11]. As a result of the implementation of the given approach the option of complex dismantling of Lepse ship has been chosen and proved. The offered option has met with approval both from the Russian departments and supervising bodies, the European commission, and public ecological organizations and the public.

Other important direction of PDPD and EIA development experience accumulated by NPS dismantling may be the implementation of projects of Navy on-shore facilities remediation. As an example we may consider SRW storage facilities at Zvezdochka Shipyard, (building 162) and Zvezda Shipyard (building 130). More arduous conditions are at the enterprises of SevRAO (interim storage facilities in Andreev Bay and Gremikha), and DalRAO (interim storage facility in Sysoyev Bay).

SRW storage facilities at the enterprises of the ship-building industry were commissioned in 1959-1964 for NPS construction and repair. Under the construction of these facilities it was supposed to store SRW for short time and to transfer it to Navy, which was responsible for RW management. Since 1990 the Navy did not accept RW from the industry in connection with refusal of the USSR practice of RW disposal at sea. For this reason SRW was accumulated in storage facilities.

Now SRW storage facilities are filled in full or in part and they are not used and inhibited. The organizations being owners of the facilities adhere to the concept of "the postponed decision", at the same time there is a destruction of building structures and there is a threat of radioactive substances discharge in the environment.

Plans of storage facility decommissioning in accordance with OSPORB-99 requirements were not developed up to 2001. [12].

Since 2001 work on storage facilities inspection and documentation development on their remediation was started.

The start of documentation development showed the unavailability of the specialized normative base and revealed a number of specific features of RW management at the ship-

building enterprises, such as the lack of the certificated containers for long-term storage of waste with medium and high activity.

According to OSPORB-99 when the radiation hazardous facility is decommissioned it is necessary to develop a detailed plan (package of documentation) that should include should include:

- The actions of maintenance of radiation situation;
- The description of preparation of the necessary equipment for dismantling works;
- Methods and means of equipment decontamination;
- The order of RW handling;
- The evaluation of the individual and collective doses of irradiation of the personnel and the population.

But the requirements for the structure of the decommissioning plan and for assessment and justification of effect on the environment are not specified in the OSPORB - 99.

There are no specific-purpose documents for decommissioning and dismantling of the radiation hazardous buildings and structures. For this purpose an attempt is made in some designs developed for Rosatom and Rosprom enterprises to use standards for construction of buildings and structures and to consider SNIP 11-01-95 [13], covering building and reconstruction to be a basic document. At that it brings difficulties in development and justification of some design sections such as, for example, "efficiency of investments" which should give evaluation of economic benefit of investments. In case of radiation hazardous facility being decommissioned and dismantled it is scarcely possible to evaluate direct economic effect.

Other problem of projects development is creation of the infrastructure for RW and SNF management when facilities are being decommissioned. By construction of the capital structures (that is caused by use of normative base in construction) time and cost of works on decommissioning and remediation increases, besides there is a problem of decommissioning of the constructed structures after the end of operations concerning the facility itself.

The problem of evaluation and justification of the environmental impact by development of projects of on-shore facilities remediation has much in common with problems of EIA development by NPS dismantling. EIA is carried out for existing facility and should take planned and existent potential impact into account in case of non-acceptance of remediation measures.

In view of the experience of RW storage facility remediation at the site of Kurchatov Institute [3-4] and at the territory of the former Navy training center in Paldiski (Estonia) [5] it is proposed to take the experience of NPS dismantling into account under the implementation of projects of on-shore radiation-hazardous facilities remediation of Rosatom and Rosprom.

The experience on joint EIA development under the international projects allows suggesting the following guiding principles for their successful implementation:

- a)** Experts of the involved countries should co-operate, that is, they should agree their plans for development of EIA before beginning of project and they should discuss them together on every stage of the project procedure;
- b)** EIA planning for projects should begin beforehand to prove decision-making on the project financing;
- c)** Process of EIA development should be of maximum transparency and provide interaction between the interested institutions including oversight bodies and the public.

The implementation of these principles assists to perform the projects duly and finish them successfully, to promote a transparency and deep trust between the interested institutions and the public.

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