

ENVIRONMENTAL POLICY ON RADWASTE MANAGEMENT AND DISPOSAL IN CHINA

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ABSTRACT

This paper introduces the environmental policy on radwaste management and disposal.

In order to prevent different kinds of radwaste from polluting environment, ensure public health, and simultaneously promote the development of nuclear energy and nuclear technology, a set of environmental policies on radwaste management and disposal has been established. The major policy are as follows:

- Solidifying the temporarily-stored radioactive liquid waste as early as possible
- Limiting the temporarily-stored time for intermediate-and low-level solidified radwaste, and solid radwaste.
- Constructing regional disposal repository for Low and Intermediate level radwaste (L/ILW)
- The radwaste and spent radiation sources arising from nuclear technology application shall be sent to the provincial waste repositories that are named City Radwaste Repository.
- The radwaste coming from the development and application of intergrown radioactive mineral resources should be stored in the dams which have to be provided.

1. Introduction

The development of nuclear power and nuclear technology brings a great of benefit to the mankind, but, at the same time, it produces the radwastes. Nowadays, all countries pay great attention to the management of radwaste. "The Agenda of the 21st Century" mapped out on the World Environment and Development Conference in Brazil in 1992, has a special chapter discussing the environmental management of radwaste. This shows that radwaste has become the important subject of environmental protection. China's nuclear industry and nuclear technology application has a history of dozens of years. The environmental management of radwaste has been thought highly of in a very early date. In 1982, the National Environmental Protection Agency (NEPA) was authorized to take the responsibility for managing the radwaste of the whole country. This paper is intended to introduce simply the management and disposal policy on the radwaste of our country.

2. China's Environmental Protection Authorities Responsible for the Management of Radwaste

"The Environment Protection Law of PRC" (trial version) (1979) stipulated in its No. 16 Article the key elements of environmental pollution to be prevented and treated;

"Actively prevent and treat the pollution and harm of harmful substances such as; waste gas, liquid waste, waste residue, dust, garbage, radiation substance etc, noise, vibration and foul smell produced from industrial and mining enterprises and cities to the environment."

In this Article, the radioactive substance is stipulated together with other harmful substances as the contents of environmental protection.

Soon afterward, in the 26 Article of the Law, it also defines the organization of the environmental protection and its function;

"The State Council establishes the environmental protection organization, whose main duties are:

- (1) Implementing and supervising the execution of State's general and specific policies, law, and decree on environmental protection;
- (2) Mapping out, jointly with other departments concerned, environmental protection regulations, stipulations, standards, and economic and technical policies;
- (3) Formulating, jointly with other departments concerned, long-term program and annual plan; and supervising and inspecting their execution;
- (4) Carrying out environmental monitor under unified organization; investigating and mastering status and developing tendency of country's environment; and putting forward the improvement measures;
- (5) Organizing and coordinating, jointly with other departments concerned, environmental science research and environmental education cause. Actively popularizing domestic and foreign advanced experience and technique of environmental protection;
- (6) Giving guidance to the subordinate departments of the State Council, provinces, autonomous regions, and municipalities on the work of environmental protection; and
- (7) Organizing and coordinating international cooperation and exchange of environmental protection."

Combining these articles, it shows that the Environment Protection Law has authorized the environmental protection authorities to assume the responsibility for preventing and treating radioactive contamination.

According to the Environment Protection Law (trial version), the NEPA was established in 1982, which took charge of executing the tasks that were authorized by the Law. On October 19 of the same year, the then Secretary-General suggested the proposal as follows;

"The Environmental Protection agency will take charge of the centralized management of whole country's radwaste. It's main tasks are; unified planning, organizing coordination, and supervising and inspecting the activities of environmental protection. The Ministry of Nuclear Industry (the predecessor of China National Nuclear Corporation), the Ministry of Metallurgical Industry, the Ministry of Public Health, and departments and regions engaging in radioactive activities should take charge of the arrangement of radwaste disposal and storage of their own system and regions."

On October 21 of the same year, the State Council approved the above proposal. The NEPA is responsible for the centralized management of country's radwaste.

3. Sources of Radwaste and Their Classification in Light of Management

In China, the radwaste mainly comes from the China National Nuclear Corporation (CNNC), the Ministry of Metallurgical Industry (MMI) and the Ministry of Public Health (MPH) (see Fig. 1).

The CNNC owns uranium mines, refineries, hydrometallurgical mills, enrichment plants, fuel element plants, various kinds of reactors and reprocessing plants. Now nuclear power plants are also started to be built. In the past 30 years, the CNNC produced numerous radwaste, which is referred as the nuclear facility radwaste (NFRW).

The MMI has non-ferrous metal ore deposit and rare earth ore deposits (China is rich in rare earth). Some non-ferrous metals and rare earth elements intergrow with uranium and thorium during mineralization. In mining those ore deposits, the underground associated uranium will be brought to the surface, sometimes the radioactivity content of tailings may reach the radwaste level. In regard to such radwaste, the management should be enhanced too. This kind of radwaste is referred as the intergrown ore radwaste (IO RW).

The MHP uses nuclear technology for diagnosis and therapy. Besides, the nuclear technology is also used in agriculture, industry, scientific research and education. These activities may also produce radwastes named nuclear technology application radwaste (NTARW).

4. Environmental Policy on Radwaste Management and Disposal

Authorized by the State Council, the NEPA is responsible for the centralized management of whole country's radwaste. In order to have an efficient management, we pursue the criss-cross type managing approach, of which the vertical aspect refers to the management of every stage from radwaste production to treatment, storage, transportation, until to final disposal, while the horizontal aspect refers to as such management as formulating the standard, reviewing and approving the environmental impact report, carrying out on-site supervision and monitor etc. Fig. 2 shows the major points of horizontal management.

The purpose of criss-cross management system is to effectively protect the environment, and effectively prevent radwaste from entering the living environment of mankind. The corresponding environmental policy of different kind of radwastes has been worked out.

4.1 Management and disposal policy for the L/ILW of nuclear facilities

The disposal policy for the L/ILW of nuclear facilities has experienced a course of development. In the early stage, the radwaste was placed on the spot near the facility. In recent years, after studying the transportation cost and the risk of radwaste, the regional disposal is believed to be feasible. Now, the regional disposal policy of L/ILW for the nuclear facilities has been approved by the Chinese government. The main points are as follows:

- Solidify the temporarily-stored radioactive liquid waste as early as possible.
- Limit the temporary storage time of intermediate and low-level radioactive solidified waste and solid waste. The L/ILW of nuclear power plant is defined as temporarily storage for 5 years.
- Construct the regional disposal repository of L/ILW to dispose the waste to be produced in this area and its adjacent areas.
- The CNNC takes the responsibility of siting, constructing and operating of the regional disposal repository of L/ILW.
- The NEPA is responsible for reviewing and approving the environmental impact reports of disposal repository; formulating and promulgating relevant standards and regulations and guidelines; the administrative competent authorities of environmental protection of provinces, autonomous regions and municipalities are responsible for supervising the environ-

mental protection activities of disposal sites.

-Affirmation of fund raising channels.

The long-term loans shall be arranged by the relevant departments of the state; and part of the capital construction cost of nuclear power plant shall be allocated as the initial fund, which is used mainly in the pre-stage work, construction and initial operation.

The disposal repository, as constructed, provides service on the basis of compensatory approach. The income collected herefrom will be used to pay off the loans, and maintain the operation.

4. 2 Environmental policy on high-level radwaste disposal

The high-level radwaste includes spent fuel, to which the policy is temporarily stored with care, while those liquid radwaste shall be solidified. The deep geological disposal are adopted at dozens of years later.

4. 3 Management and disposal policy for NTARW

As early as 1987, China had published the management criteria for NTARW whose major points are as follows:

- All users of radioisotopes and nuclear technology including those in industry, agriculture, medicine, scientific research and education departments where radwaste and spent radiation sources are produced shall adhere to this criteria.
 - The environmental protection authorities of each province, autonomous region, and municipality, special organization shall be set up and staffed with professionals to take charge of centralized supervision, management, and environment monitor of the radwaste from nuclear technology application.
 - Any contaminant containing artificial radionuclides with specific activity greater than 2×10^4 Bq/Kg, or containing natural radionuclides with specific activity greater than 7.4×10^4 Bq/kg, shall be treated as radwaste.
 - The radwaste from nuclear technology application can be classified as three categories in terms of their half-lives:
 - Short-life radwaste $T_{1/2} \leq 60$ days
 - Medium half-life radwaste $60 \text{ days} < T_{1/2} \leq 5.3$ years
 - Long half-life radwaste $T_{1/2} > 5.3$ years
 - Any user producing radwaste shall take all necessary measures to minimize waste amount or waste volume. It is not allowed to dispose radwaste and spent radiation sources in the environment by user itself. They shall be collected and disposed in a centralized way by the management authorities for radwaste from nuclear technology application.
 - The radwaste shall be well-packed. The surface dose rate of each bag shall not exceed 0.1 mSv/h, the volume is controlled under 30 l, and the weight, under 20 kg. The external surface contamination of the package shall be controlled to the following levels respectively:
 - $\alpha < 0.04 \text{ Bq/cm}^2$
 - $\beta < 0.4 \text{ Bq/cm}^2$
- The external surface dose rate of the special vehicle for transportation shall be lower than 0.2 mSv/h, and that in the driver's cab shall be lower than 0.025 mSv/h.
- The packed radwaste, when entering the waste repository shall be inspected and accepted individually. The registration cards shall be well filled, and the time of retaining the cards shall not be less than the time that the radwaste becomes harmless.
 - The packed radwaste in the waste repository shall be classified and stored according to the stip-

ulation. Those radwaste and spent radiation sources which can not decay to $\leq 2 \times 10^4$ Bq/kg within the safe storage period can only be stored temporarily in the waste repository, and they shall be ensured to be withdrawn for transferring to the final disposal repository.

-During the storage period any radwaste decayed to below 2×10^4 Bq/kg can be buried as common garbage in a simply constructed pit within the repository area, after being reported to and approved by the environmental protection authorities of the province or autonomous region or municipality concerned.

-The environment inside and around the repository area shall be monitored periodically.

4.4 Policy on intergrown ore radwaste

(1) The large amount of radwaste formed during mining shall be stored in the tailings dam.

(2) The small amount of radwaste formed during the processing of rare earth shall be stored temporarily in the waste repository for NTARW, and later shall be sent to the nearby tailings dam for NFRW or for IORW.

5. Implementation of Environmental Policy on Radwaste Management and Disposal

According to the Environment Protection Law, the authorities of environmental protection are responsible for the centralized supervision and management of radwaste, while the competent authorities of the users that produce the radwaste are responsible for the management of their own radwaste. On the basis of this principle, in the execution of environmental policy on radwaste management and disposal, two aspects of initiative have to be brought into play: one is the role of environmental protection authorities; and the other is that of the users that produce the radwaste, and their competent authorities.

Besides, in regard to the high-level radwaste, especially the spent fuel, the issues of nuclear safety and substantial guarding are involved with. Also, the spent radiation sources arising from nuclear technology application has the problem of security and guarding. Referring to such problems, the environmental protection authorities have to cooperate closely with the National Nuclear Safety Administration (NNSA) and the Ministry of Public Security (MPS) to arrange the work concerned well. Fig. 3 shows the relationship between the NEPA, the NNSA and the MPS on the management of radwaste.

For effectively implementing the environmental policy, it is intended that different management is to be used for different kind of waste. Figs. 4, 5, 6 and 7 give respectively the management flow charts of L/ILW of nuclear facilities; high-level radwaste of nuclear facilities; radwaste from nuclear technology application and radwaste from intergrown ore. At present, the management of radwaste have run according to these procedures. Practice proves that China's environmental policy is effective and feasible.

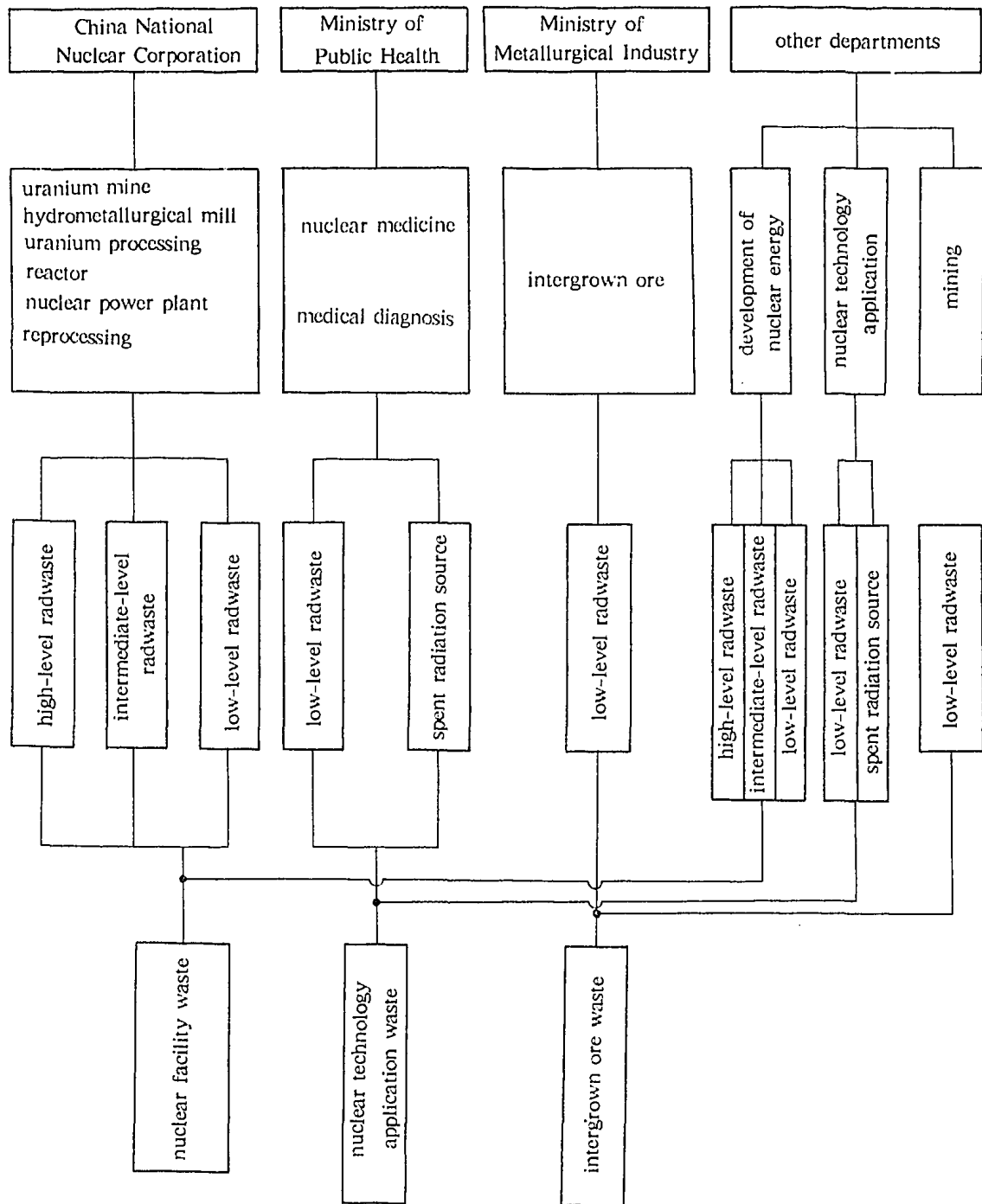


Fig. 1 Production channel of radwaste

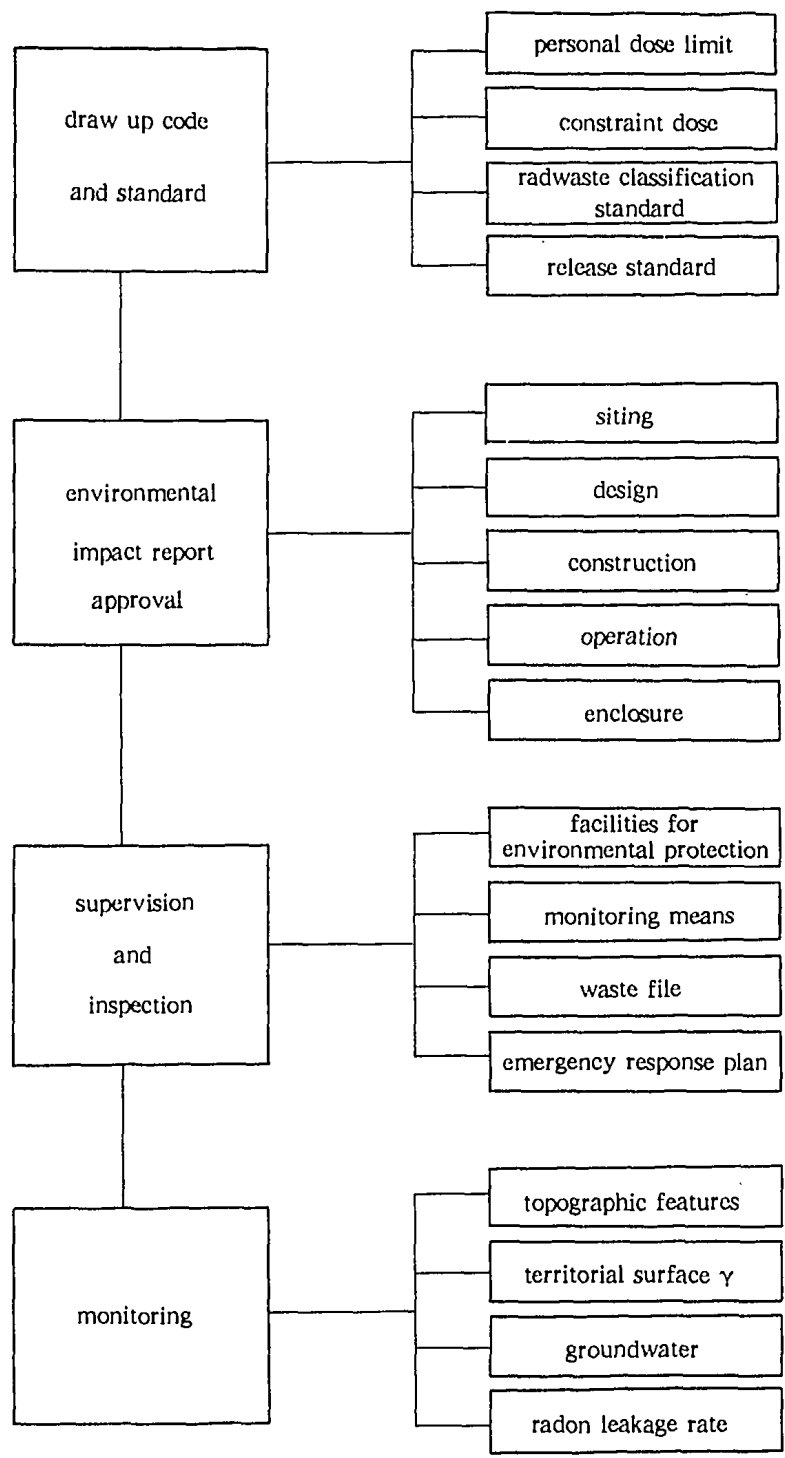


Fig. 2 Main points of environmental protection management of radwaste disposal

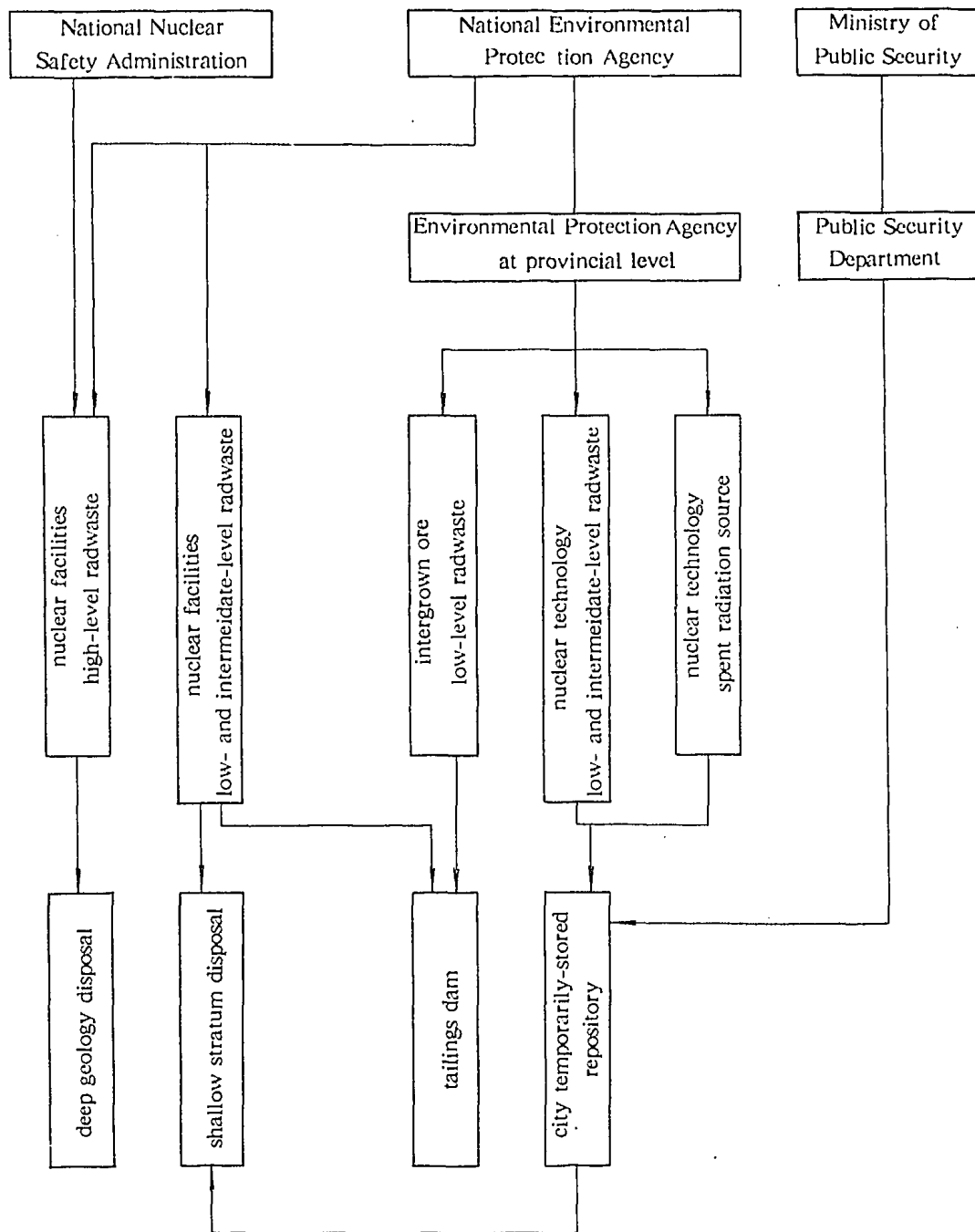


Fig. 3 Relationship chart of management for waste disposal

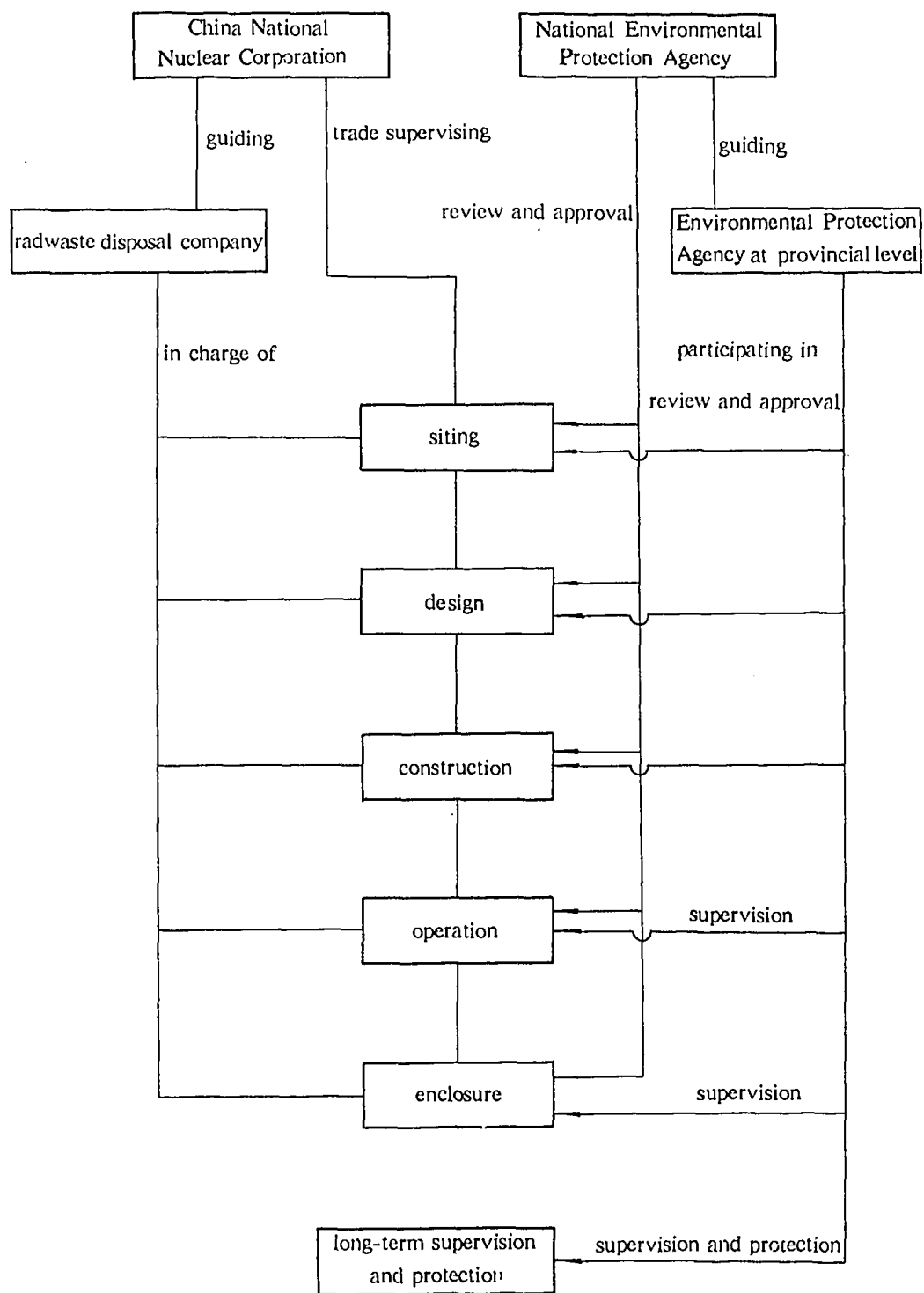


Fig. 4 Management flow chart for intermediate and low-level radwaste disposal from nuclear facilities

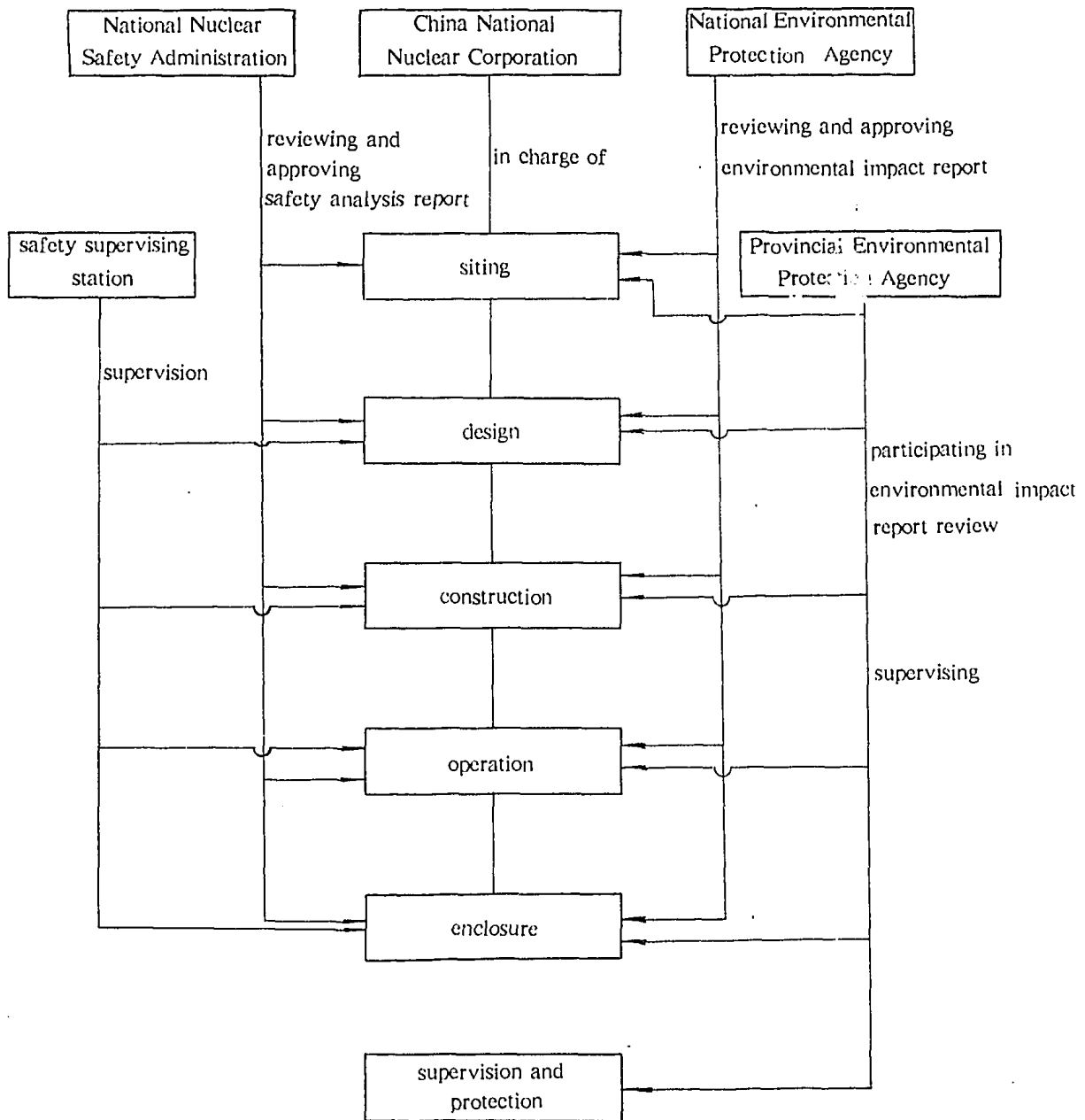


Fig. 5 Management and disposal flow chart of high-level radwaste

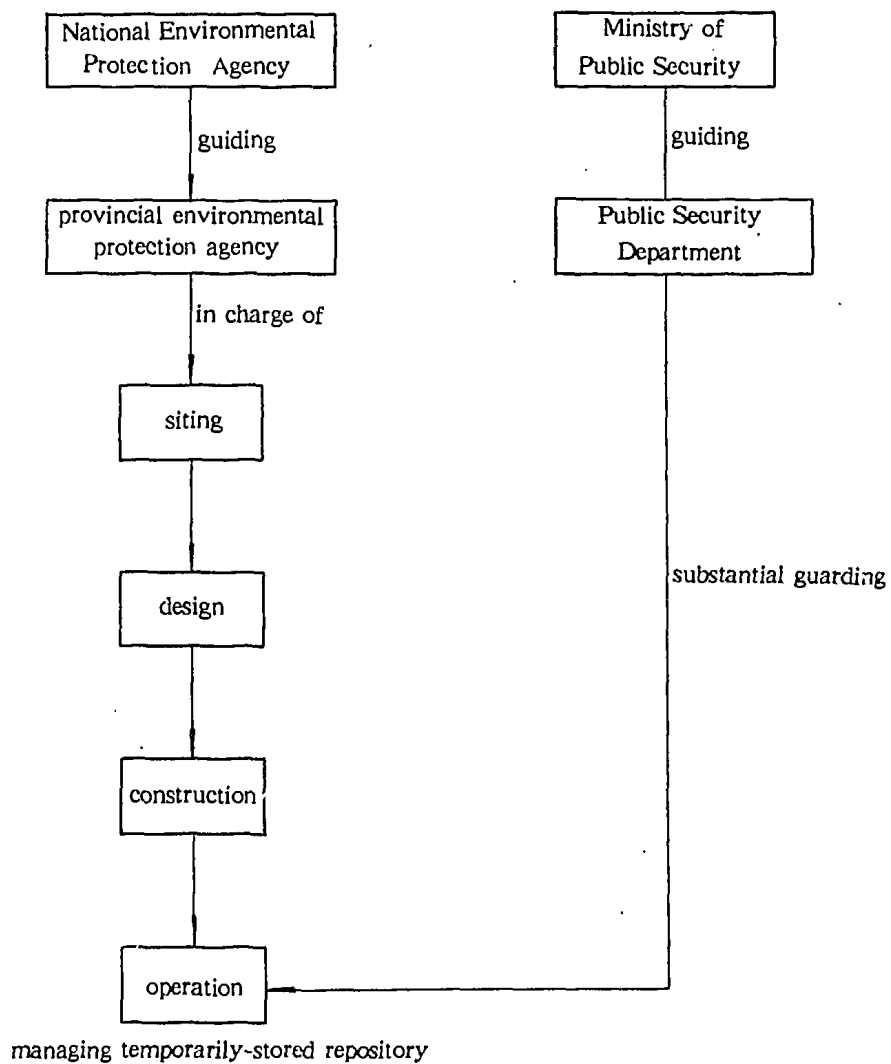


Fig. 6 Management flow chart of radwaste from nuclear technology application

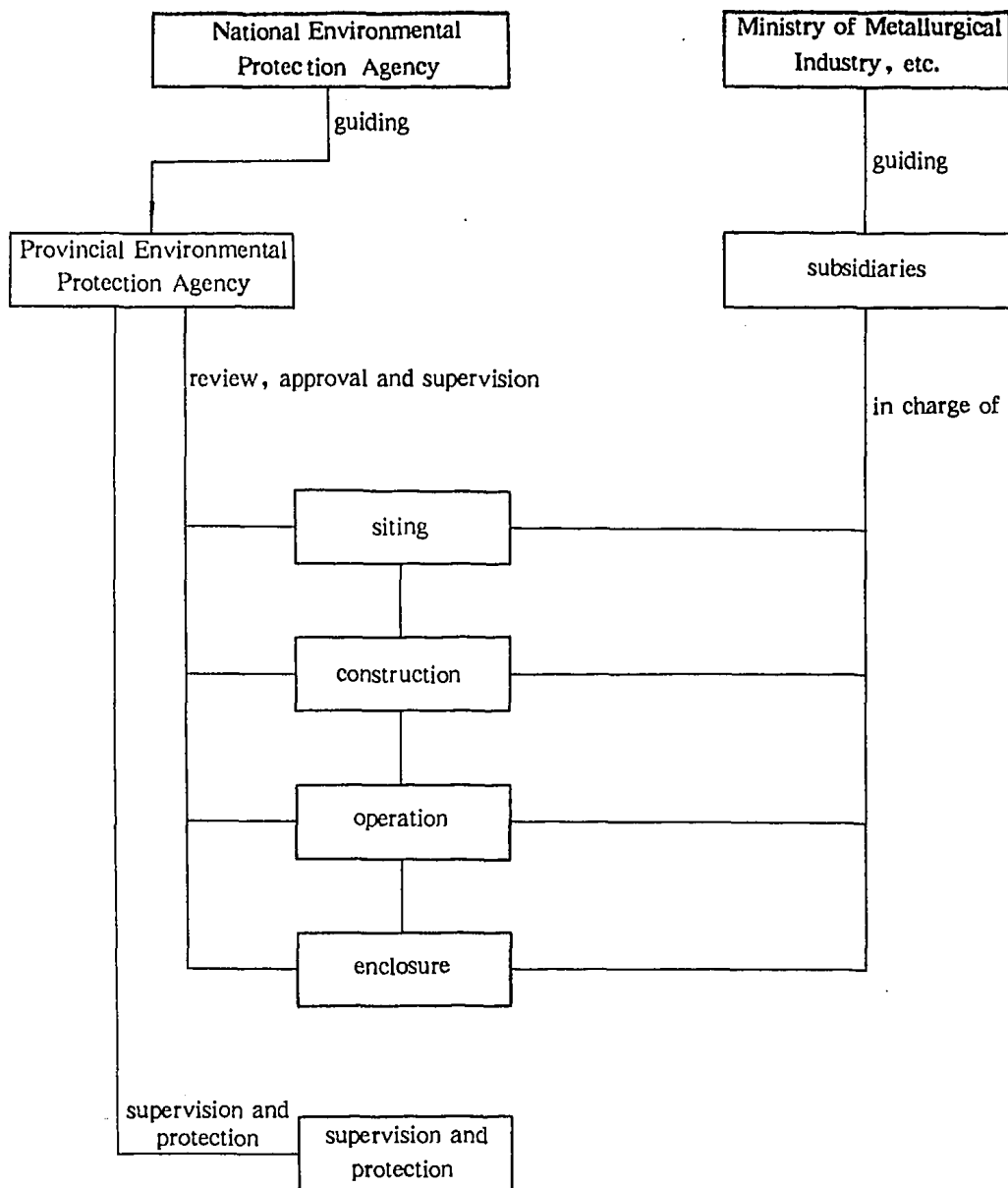


Fig. 7 Management flow chart of tailings dam for non-uranium deposit

References

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