

As of July 26, 2005

Radioactive Waste Assessment Office, Safety Standard Division
Japan Nuclear Energy Safety Organization

Safety Regulation on Decommissioning In Japan

1. History of Safety Regulation on Decommissioning in Japan

The broad outline prepared by Japan Atomic Energy Commission states that it is important for responsible establishers to proceed with decommissioning of their nuclear installations such as commercial nuclear power reactors, testing and research reactors, and nuclear fuel cycling facilities based on the Nuclear Reactor Regulation Law with a major emphasis on ensuring safety under the nation's safety regulation based on the revised said Law while obtaining the understanding and cooperation of the local community. A vacant lot of a commercial power reactor is expected to continue to be used effectively as the land for a nuclear power plant while obtaining the understanding of the local community.

Ideal ways of how to decommission and regulate reactor facilities were examined in the "Basic Concept of Ensuring Safety Related to Decommissioning of Reactor Facilities" (determined by the Nuclear Safety Commission in December 1985, revised in August 2001), "Towards Decommissioning of Commercial Nuclear Power Generation Facilities" (Nuclear Power Subcommittee, Comprehensive Resources and Energy Advisory Committee in January 1997), and "Ensuring Safety and Safety Regulation Related to Decommissioning of Commercial Power Reactor Facilities" (Decommissioning Safety Subcommittee, Nuclear Safety and Security Division, Comprehensive Resources and Energy Advisory Committee in August 2001). Based on these reports, for decommissioning of commercial power reactor facilities, the means (submission of the dismantling notification and alterations of safety preservation rules) provided in the Nuclear Reactor Regulation Law have properly been used and regulation to ensure that measures for ensuring safety would be taken by licensees has been implemented.

In addition, experience has been acquired on decommissioning of nuclear installations at the Japan Power Demonstration Reactor (JPDR) of Japan Atomic Energy Research Institute and Tokai Power Generation Station of The Japan Atomic Power Co. Dismantling technology available to decommissioning has been developed and on-the-spot testing has been conducted. Knowledge related to decommissioning has been accumulated during this process.

Under these circumstances, Nuclear safety Commission pointed out in the Ideal Way of the Safety Regulation System Following the End of Operating Nuclear Installations (October 14, 2004) that “major activities for safety preservation include the management of spent fuels, dismantling work, and its accompanying radiation management and handling of radioactive wastes. It is necessary to consider the buildup of a step-by-step safety regulation system in accordance with progress in dismantling and the importance of ensuring safety based on accumulated regulatory experience related to decommissioning.”

Decommissioning Safety Subcommittee is under consideration of regulations in terms of ensuring their transparency and suitability for the decommissioning phase based on regulatory experience related to decommissioning of nuclear installations under the current system and with an eye to revising legislation and the major premise of ensuring required safety. It is also under study of extracting the issues of the decommissioning regulation system for decommissioning of nuclear installations and the ideal situation of a future regulatory system for decommissioning in order that the regulations can fully correspond to the diversity by installation, accumulation of future experience on decommissioning as well as technological progress (Ideal way of Decommissioning Regulations for Nuclear Installations (December 19, 2004)).

This report recognized that reviewing the ideal way of the regulation system including the nation’s involvement and the responsibilities of the licensee suitable for the stage of decommissioning with a major emphasis on ensuring safety required towards decommissioning of nuclear reactors on a full-scale basis would be considered important for the following matters: (i) setting the clear standards for decommissioning regulation, (ii) ensuring high transparency of procedures for the regulated person (nuclear licensee), and (iii) acquiring the understanding and reliability of nation’s people and local residents. It also proposed the following: As the ideal way of decommissioning regulation, the nation shall approve a decommissioning program related to the process, method, etc. of dismantling instead of the “notification,” the program shall be transferred to the decommissioning stage with this approval, the nation shall confirm decommissioning implemented by the licensee at the end of decommissioning, the business license, designation or license for reactor establishment shall be made invalid by the nation confirming the end of decommissioning, and ensuring safety (periodical facility inspection, safety preservation inspection, etc.) shall be implemented on a step-by-step basis in response to progress in decommissioning and changes in the functions and contents of safety preservation activities requested for a facility.

In this proposal, the licensee is requested to have forecast the entire decommissioning period and describe facility dismantling and other decommissioning processes, how to

dispose of materials contaminated by nuclear fuel materials, safety assessment, financing, etc. Then, the licensee shall apply for approval and the nation shall review if the application complies with the technical standards for approval. The licensee shall implement decommissioning in accordance with the approved decommissioning program. However, since decommissioning normally continues for a long period of time, the licensee must take it into consideration to ensure a perceptible that decommissioning would be firmly implemented and to let the sequential development of a program related to the relevant process be approved prior to the start of each decommissioning process via the procedures for approval of altering the initial program.

The Nuclear Reactor Regulation Law according to this concept was enacted in the Diet session in May 2005 and its related legislation was enforced on December 2005.

The following describes the technical part of the history of revision in detail.

2. Points of Safety Regulation System for Decommissioning

The following five points should be taken into account when nuclear installations are dismantled in the basic concept of ensuring safety related to their dismantling made up by Nuclear Safety Commission in 2001:

(1) Ideal way of reactor function shutdown measures

All nuclear fuels and neutron sources shall be removed from the core of a reactor. Those nuclear fuels removed shall be taken out from the facility or stored in the storage facility.

(2) Ideal way of maintenance management of a reactor facility under dismantling

The third party shall be prevented from its illegal access to the reactor facility under dismantling. The control area shall be properly divided to prevent radiation workers from being exposed unnecessary to radiation. To prevent residual radioactive materials in a system of the reactor facility from their leakage, the system shall be properly isolated or sealed.

(3) Ideal way of ensuring safety in dismantling activities

The generated amount of residual radioactive materials and wastes shall be assessed. The procedures and methods of dismantling activities shall be chosen keeping in mind decontamination, securing shields, etc. Public safety shall be ensured to reduce the release of radioactive dust out of the facility, etc.

(4) Ideal way of confirming the completion of dismantling

All nuclear fuels have been removed and radioactive waste shall be properly disposed of.

(5) Reduction in exposure

For dismantling of a reactor, safety shall be ensured based on the concept of the fundamental principles of ALARA (As Low As Reasonably Achievable: all exposures must be low reasonably as achievable as possible taking into economical and social factors into account), one of the foundations of the dose limitation system indicated by International Committee on Radiation Protection (ICRP).

These concepts are basically applicable to nuclear fuel facilities, etc. as well.

For the consideration of the safety regulation system after the end of operation, the features of a nuclear facility as discussed later were picked up in addition to the points as mentioned above. Specifically,

- (1) Danger caused by operation will be eliminated by the end of operation.
- (2) The amount of nuclear fuel materials or radioactivity will be reduced that exists in the processes from the reactor itself to nuclear fuel facility, etc. at each phase of the end of operation, from the start to the end of dismantling, and from the end of dismantling to disposal.
- (3) Safety preservation activities after the end of operation mainly involve exposure control related to dismantling, management of radioactive wastes generated by dismantling, nuclear fuel material management, etc. It is important to implement these tasks in a proper manner.

3. Features of Nuclear Facility during Decommissioning

It is necessary to consider the safety regulation system related to decommissioning of reactor installations based properly on their features and degree of their potential danger after the end of their operation. The following shows the features by installation that were investigated discussed by the Special Committee on Radioactive Waste and Decommissioning.

3.1 Reactor installation

- (1) In addition to the types, powers, etc. of reactors such as nuclear power reactors, research and development reactors, research reactors for testing, and experimental equipment on criticality, there are a wide variety features including those of a reactor for power reactor that is operated for a long period of time and those of a research reactor that are operated only when experiments are made. The activation (a phenomenon that a non-radioactive material becomes a radioactive material by the irradiation of neutron) of equipment and structures is largely different as well as the degree and range of contamination by a radioactive material.

- (2) The items that should be taken into account in terms of ensuring safety when a reactor installation is dismantled are different by reactor. For example, experimental equipment on criticality, etc. is less affected by activation and easy to control exposure during decommissioning compared with a nuclear power reactor.
- (3) The amount of radioactivity contained in a reactor installation reduces at each phase of the end of operation, taking spent fuels out of the installation, and dismantling and removal of the core. In addition, if spent fuels are carried out, there will be no possibility of criticality.
- (4) When a nuclear installation is decommissioned, a nuclear power reactor basically aims at changing its site to a vacant lot, but those except the nuclear power reactor, for example, a reactor building is possibly reused for any other purpose.

3.2 Refining or treatment facility

- (1) Nuclear fuel materials, etc. that were used for business are recovered at the end of operation of a refining or treatment facility, but there is the possibility of residual radioactive wastes or nuclear fuel materials (depleted uranium, scrap) contaminated with these nuclear fuel materials as referred to.
- (2) A refining or treatment facility may be separated into multiple facilities depending on its business operation patterns. It can be thought that it is divided into some pieces for dismantling, not as a whole at a time.
- (3) The point to be kept in mind for dismantling is the contamination by residual uranium, etc. in the process because there is possible exposure to workers during dismantling. On the other hand, In case of the assembly facility of a treatment facility, the possibility of contamination by radioactive materials is extremely low and it may easier to dismantle than a nuclear power reactor or re-treatment facility.
- (4) When a treatment facility that treats plutonium is dismantled, it is particularly necessary to take containment and internal exposure into consideration.

3.3 Re-treatment facility

- (1) Since there are multiple facilities for the processes from the main process of re-treatment to the vitrification process, it may be thought that dismantling is not performed not collectively, but by facility immediately after the end of their service.
- (2) When the re-treatment facility is dismantled, it is necessary to take into consideration contamination by plutonium or fission products by facility (there are some facilities with activation taken into consideration).

3.4 Disposal facility (burying, management)

- (1) In case of a burying facility (except the waste burying land), it can be thought that there are less points of ensuring safety such as exposure during dismantling because of the less amount of residual radioactivity after wastes are buried.
- (2) Dismantling of a control facility that processes and stores radioactive wastes like Oharai Institute of Japan Atomic Energy Research Institute can be thought to have the same level of potential danger as the disposal facility in other nuclear installations. On the other hand, the control facility for vitrified materials can be thought to have a low level of potential danger because the amount of residual radioactivity after taking these vitrified material out of a place of business, but it is necessary to take into account of some activated materials.

3.5 Usage facility

- (1) Usage facilities range diversely from those that deal with a small amount of nuclear fuel materials to those that deal with spent fuels containing a large amount of radioactive materials.
- (2) A usage facility that deal with a large amount of plutonium, spent fuel, etc. may have a larger level of potential danger than a processing facility or a test reactor.
- (3) The items to be considered in terms of ensuring safety when a usage facility is dismantled must be taken into account in accordance with the features of each relevant facility such as the degree of contamination or activation.

The common subjects to the facilities that are decommissioned excluding a disposal facility are how to ensure a disposal place and how to discharge nuclear fuel materials.

4. Issues Pointed Out by the Old Safety Regulation System at the Decommissioning Phase

4.1 Results of regulatory investigation

The following are the current situations and problems of the safety regulation system after the end of operation of reactor installations, which were indicated by the results of the regulatory investigations put together by the Nuclear Safety Commission in October 2004.

- (1) The current safety regulation system places emphasis on the regulations required for the installation and operation of a reactor installation. Since there was no experience on its dismantling or disposal at the time when the Nuclear Reactor Regulation Law

was established, the system did not take into account the safety regulation after the end of operation such as dismantling or disposal in a sufficiently legislative manner.

- (2) The major safety preservation activities carried by a licensee who installed a reactor installed after the end of operation are different from those in operation and include spent fuel management, dismantling and its accompanying radiation management, and handling of radioactive wastes. It is necessary to change the contents of safety preservation in response to differences in safety preservation activities in order to firmly ensure safety.
- (3) Dismantling causes the condition of a facility to change day by day in accordance with its progress. Thus, it is necessary to examine safety regulation so that required inspection or confirmation can be implemented during a proper period of time according to the degree of importance of ensuring safety requested for the facility.
- (4) The regulatory government agency should be expected to begin to review the safety regulation system with the features such as differences between the nuclear power reactor and the reactor for testing and research taken into consideration.

4.2 Results of Study by Special Committee on Radioactive Waste and Decommissioning

In addition, as a result of study by the Special Committee on Radioactive Waste and Decommissioning, the following were pointed out as the current situations and problems of the safety regulation system at the phase of decommissioning of a nuclear fuel facility, etc.

- (1) Nuclear facilities, etc. are different in their features and operation patterns depending on their types. For instance, nuclear fuel materials in an installation are steadily recovered even when it is in normal operation or there are some facilities to deal with those nuclear fuel materials not sealed.
- (2) At present, safety regulation related to dismantling is not systematized for large-scale usage facilities such as testing facilities after the irradiation of fuels, etc.
- (3) If nuclear fuel materials, etc. or radioactive wastes cannot be discharged even after the end of dismantling, decommissioning will not be completed.
- (4) A nuclear fuel facility has differences from a nuclear installation and its own problems, but these are common problems to the nuclear installation and required to be taken into account when a decommissioning related system should be taken into consideration.

4.3 Results of Study by Decommissioning Safety Subcommittee

In addition, according to the “Ideal Way of Decommissioning Regulation of Nuclear Installations” (in December 2004) prepared by the Decommissioning Safety Subcommittee

of Nuclear and Industry Safety Agency, the following were raised as the problems of the old decommissioning regulation:

(1) Problems of decommissioning regulation

(i) The regulatory procedures for dismantling provides the obligation to submit the dismantling notification thirty days before dismantling of a processing facility, a nuclear installation, a spent fuel storage facility or a reprocessing facility is launched, and also the issuance of the order for measures required for disaster prevention. When the dismantling notification is validated, the criteria rely on the decision of the Nuclear Safety Commission and reports from the Decommissioning Safety Subcommittee.

However, the current regulation is based on the “notification” system that it confirms only the requirement of the format without any substantial review. The technological and issuance criteria for the order of measures related to dismantling are legislatively defined.

(ii) The procedures for the termination of the regulation provides the obligation of submitting the decommissioning notification at the end of operation (within thirty days after the end of operation) and the issuance of the order of measures required for disaster prevention, but they are based on the “notification” system that the regulatory government agency confirms only the requirements of the format and the procedures are not developed for confirming the contents (measures taken by the reactor establisher) of the notification by the nation.

(iii) The regulation during dismantling imposes various obligations on the service stage even at the stage of decommissioning. In general, the stage of decommissioning greatly reduces the danger of disaster compared with the service stage due to the permanent operation shutdown, removal of fuels from the core, etc., and the contents of functions and safety preservation activities required for a facility vary in a sequential way. Thus, if the features of the said decommissioning are taken into account, the decommissioning regulation is suitable if it is based on a step-by-step approach in accordance with progress in decommissioning, but the current system does not meet this requirement.

(iv) Some of the procedures for decommissioning of reactors provide that the reactor establisher shall submit the decommissioning notification when “the establisher decommissions all reactor related to its license.” However, one license is given per place of business even if the establisher owns multiple reactors and it is not apparent whether the decommissioning notification is submitted in case some of reactors are shutdown on a permanent basis.

For a reactor for testing and research, if one of multiple reactors related to one license for reactor establishment is shutdown, decommissioning per reactor is approved and the decommissioning notification is requested to submit and the license for the establishment of the specific reactor is made partially invalid. For decommissioning of a commercial power reactor, the mainstream is that one of multiple reactors related to one license for reactor establishment is decommissioned, which is needed to be put in order.

(2) Ideal way of decommissioning of nuclear installations

The Subcommittee on Decommissioning Safety has developed various points that should be taken into consideration to examine future decommissioning of nuclear installation based on the problems involving the current decommissioning regulation as described in (1). However, the scope concerned covers each business of the refining, treatment, spent fuel storage, re-treatment and disposal as well as commercial and research and development reactors under the assignment of the Ministry of Economy, Trade and Industry.

The report defines “decommissioning” as a series of measures for handover of nuclear fuel materials, removal of contamination by these materials, and disposal of them and materials contained by them until the end of regulations based on the Nuclear Reactor Regulation Law after the end of major activities related to licensed and designated business or reactors. It also describes that the main purpose of the decommissioning regulation is to prevent disaster caused by the radioactive materials of its accompanying nuclear fuel materials, spent fuels, and radioactive wastes, etc.

- (i) As the regulation at the start of decommissioning, nation’s proper involvement shall be made clear and the system shall be suitable that the nation reviews if the decommissioning program developed by the licensee or reactor establisher meets the nation’s technical standards prior to decommissioning instead of the current dismantling or decommissioning notification in terms of systematically apparent transfer from the in-service regulation to the decommissioning regulation. Then, the ins-service regulation moves to the decommissioning regulation with the licensed decommissioning program.
- (ii) At the end of decommissioning, the nation shall finally confirm if there is no problem on the termination of the regulations of the said Law. It shall also confirm that the measures taken by the licensee or reactor establisher meets the technical standards laid down by the nation. Then, the regulations of the said Law will be terminated with this confirmation.
- (iii) At the stage of decommissioning, the system shall allow step-by-step regulations to

apply in response to changes in the degree of the importance of ensuring safety with progress in decommissioning such as a reduction in danger of a large amount of leakage of radioactive materials to the environment. It is necessary to keep in mind that the level of ensuring safety depending on the presence or absence of radioactive materials or spent fuel materials in a place of business.

- (iv) The licensee or nuclear establishment is continuously obliged to ensure safety from the service stage to the decommissioning stage without any interruption. It is recommended that the approval and designation of business or the license for reactor establishment shall continue until the complete end of a series of decommissioning so that decommissioning can be implemented smoothly and be made invalid by the nation confirming the end of decommissioning.

(3) Regulations Related to the Start and End of Decommissioning

(i) Approval of the decommissioning program

The decommissioning program shall contain measures seeing through the entire decommissioning period. With a reduction in the possibility of an accident, the licensing application for this program shall be filed as follows:

- (a) When and after business operation such as treatment and re-treatment is permanently stopped and major nuclear fuel materials have been recovered from process equipment
- (b) When and after the operation of a reactor is permanently stopped and fuels have been removed from the core

The decommissioning scenario assumes that (a) the commercial power reactor uses the standard process and its period shown in the reports prepared by the Nuclear Power Division of Comprehensive Resources and Energy Advisory Committee 1985 and the Decommissioning Safety Subcommittee in 2001, respectively, as a goal, and (b) it is appropriate that those except commercial power reactors shall be individually validated to check if there is no problem in terms of ensuring safety based on the features of the relevant facility.

(ii) Confirmation of the end of decommissioning

With regard to confirmation application for the end of decommissioning, it is adequate that the licensee or nuclear establisher shall be checked by the nation to see if the measures taken by it based on its approved decommissioning program or any other measures satisfy the technical standards.

(iii) Future major standards to be developed

It will be necessary to individually examine the standards of the contents, approval

and end of the decommissioning program referring to differences between business such as treatment/re-treatment and a reactor as well as to examinations by international organizations. The technical standards to be developed in relation to decommissioning are recommended to provide performance within a possible range that can timely reflect progress in future technology and make use of private standards.

(4) Regulatory actions during decommissioning

(i) Step-by-step regulation

The basic concept should be in such a way that obligations imposed on the licensee or reactor establisher or the nation's inspection, etc. during decommissioning apply required and sufficient regulations on a step-by-step basis in light of the features of decommissioning and the scale and characteristics of the facility concerned.

(ii) Procedures for new facility construction

Regulations related to the permission or designation of business or the license for reactor establishment, approval of design and construction methods, pre-service inspection, and welding inspection are not required for the equipment and devices that are temporarily installed due to only the construction, dismantling, etc. during decommissioning. This is because these regulations are used to confirm the functions and performance of a facility or equipment for ensuring safety. The safety of these constructions shall be checked by nation's confirmation through safety preservation rules and inspection.

On the other hand, if a new facility or equipment is constructed only for decommissioning during its period, it is necessary to follow proper procedures in keeping in mind in-service procedures.

(iii) Periodical facility inspection

Since the safety function is not required during decommissioning except some facilities such as a radioactive material disposal facility, which is required in service, it is appropriate that the facility maintenance management that is needed to maintain the function during decommissioning is on the basis of safety preservation activities carried out by the licensee or reactor establisher and that the proper implementation situation is supervised through the safety preservation inspection by the nation. In this case, if spent fuels or nuclear fuel material exist in the facility concerned, it is necessary to take the fact into consideration.

(iv) Safety preservation rules and inspection

The safety preservation rules are an important means for regulation at the

decommissioning stage together with the decommissioning program. Thus, for the safety preservation rules during decommissioning, it is made important that the nation indicates their contents clearly based on the characteristics of the decommissioning stage to verify if the safety preservation activity system is ensured through the permission for alteration.

The frequency of safety preservation inspection is desirable to be set with flexibility in accordance with the importance of the decommissioning process and ensuring safety.

(v) Supervision of safety preservation during decommissioning

The contents of the supervision of safety preservation with progress in decommissioning after criticality management do not always require the knowledge of reactor operation control and nuclear material criticality management. Thus, it is considered adequate that the qualification requirements of the chief engineer of reactors, etc. may be replaced with other qualification requirements in accordance with the contents of progress in decommissioning and the contents of the supervision of safety preservation.

(vi) Protection of nuclear materials

It is made necessary to ensure proper regulations until the end of handling specific nuclear fuel materials requiring protection.

(vii) Quality assurance

Safety preservation activities during decommissioning are required to implement in the state of changes in the condition of a facility with progress in construction. In particular, it is necessary to properly divide and manage a large amount of various wastes that occur for a long period of time. As a result, it is made necessary to ask the licensee to establish the appropriate quality assurance system and implement proper quality assurance activities, which is verified by the nation through the inspection of safety preservation, etc.

(viii) Other regulatory actions

It is made necessary to continuously apply the on-site search, report collection and order of measures during decommissioning in the same way as during in-service and to implement proper regulatory monitoring. It is also made adequate that the contents of the measures needed for safety preservation imposed on the licensee or reactor establisher during decommissioning are based on the characteristics of decommissioning to be implemented and progress.

(5) Points of concern for study

(i) If one of multiple reactors related to one license to establish reactors is dismantled, it is

considered reasonable to approve the decommissioning program by reactor and move to decommissioning regulations by reactor. In such a case, when the nation has verified the end of decommissioning the relevant reactor, only the license to establish it shall be made invalid.

Business of processing, re-treatment, etc. is permitted and designated for its own purpose, the basic concept shall be appropriate that the decommissioning program is applied at the end of operation of a facility (for example, processing equipment in case of processing business) aimed at by the facility concerned to move to decommissioning regulations with a license of the program concerned. At this point, since the contents of business and the patterns of the facility are diverse, it is considered important to implement proper regulations in line with individual cases.

- (ii) If business licensing and designation or a license to establish a reactor is canceled, the licensee or reactor establisher winds up or dies without any transfer of approval, it is made adequate to impose decommissioning regulations in proportion to decommissioning caused by the discontinuance of business or reactor operation.
- (iii) Decommissioning regulation should build up the basic framework common to each business and reactor. On the other hand, the detailed design of the regulatory system is require to fully take into account the characteristics and current status of each business or reactor. The system should consider the flexibility of the system so that it can fully respond to accumulate experience on decommissioning and technical progress.

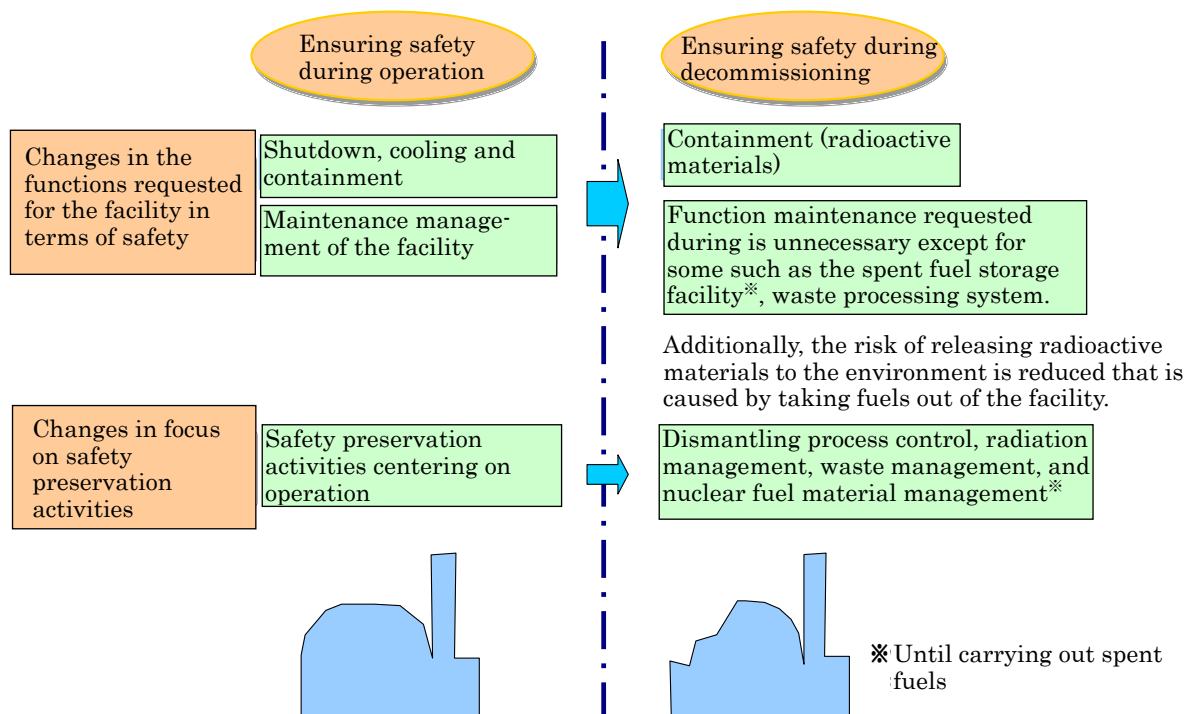


Fig. 1 Differences in the concept between during operation and during decommissioning [“Ideal way of Decommissioning Regulations on Nuclear Installation” by the Decommissioning Safety Subcommittee, Special Committee on Nuclear Safety and Safety Preservation, Comprehensive Resources and Energy Advisory Committee on December 9, 2004]

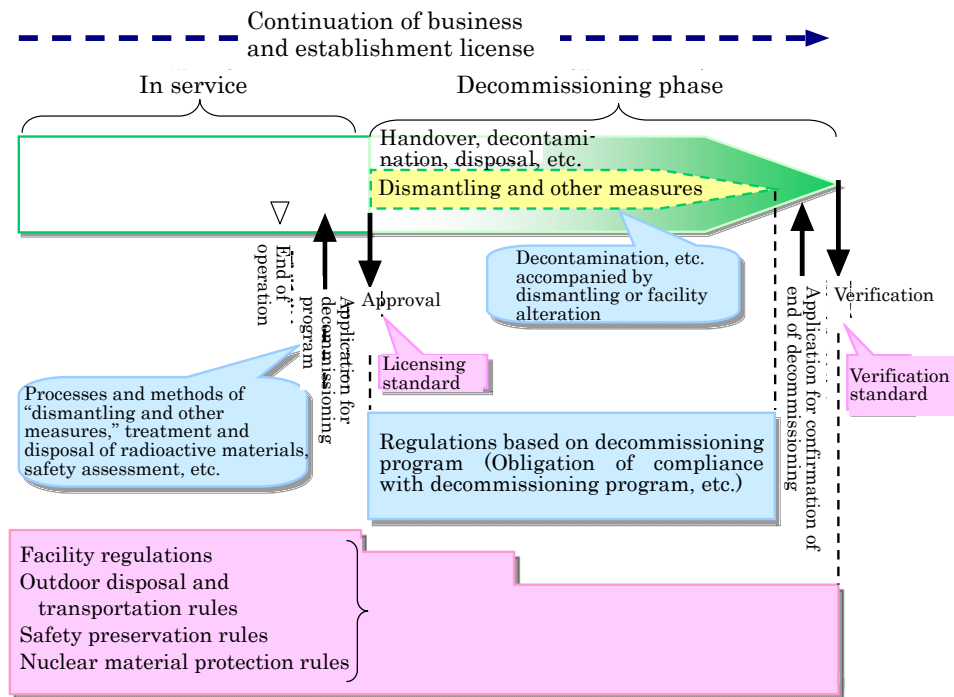


Fig. 2 Current procedures for decommissioning regulations

["Ideal way of Decommissioning Regulations on Nuclear Installation" by the Decommissioning Safety Subcommittee, Nuclear Safety and Security Division, Comprehensive Resources and Energy Advisory Committee on December 9, 2004]

5. Overview of the Revised Nuclear Reactor Regulation Law

The safety regulation system of the nuclear installations in Japan was revised on the basis of the results of study as described above. It is outlined as follows:

(1) Procedures from the reporting system to the licensing system

- The nation approves the decommissioning program related to the dismantling processes, methods, etc. This approval enables the program to move to the decommissioning phase.
- At the end of decommissioning, the nation verifies the decommissioning taken by the licensee. The permission and designation or license for reactor establishment expires by the nation verifying the end of decommissioning.

(2) Step-by-step safety regulation

- The safety regulation (periodical facility inspection, safety preservation inspection,

etc.) during decommissioning shall be implemented on a step-by-step basis in accordance with changes in the contents of the functions and safety preservation activities requested for a facility and implemented on a step-by-step basis in accordance with progress in the facility.

(3) Preparation of technical standards

With legal changes, government ordinances and ministerial orders were also revised. The ministerial order related to the revision of the decommissioning system for each nuclear installation was issued on November 11 and enforced on December 1.

The related ministerial orders include the “Rules for the Installation, Operation, etc. of Commercial Power Reactors,” “Rules for Processing Business of Nuclear Fuel Materials,” etc. and their contents are almost the same.

The major contents of the Rules for the Installation, Operation, etc. of Commercial Power Reactors are summarized as follows:

- Requirements of minor changes in the design and construction approval
- The periodical inspection is limited to facilities regarding handling facilities, disposal facilities, etc. of nuclear fuel materials.
- In case of no spent fuel materials, patrol inspection is performed and recorded once or more times a week.
- Nuclear reactors are not required to assess on a periodic basis.
- Safety preservation is inspected within four times a year.
- Standards of the contents of the decommissioning program and licensing application for program alteration and their approval
- Requirements of minor changes
- Standards of the contents of verification application for end of decommissioning and their verification

6 . Safety Assessment in Decommissioning Program

The contents of the decommissioning program are specifically provided by government ordinances and ministerial orders by facility type. Those items related to ensuring decommissioning safety are listed as follows:

- (1) A specific facility to be dismantled, how to dismantle and how to remove contamination
- (2) Distribution of contamination caused by nuclear fuel materials and how to assess it
- (3) Radiation exposure management accompanied by decommissioning (assessment of dose to the general public in the vicinity of a facility at normal times, dose to personnel engaged in radiation work during decommissioning, etc.)
- (4) Description of types, levels, effect, etc. of accidents assumed to occur in case of mistakes,

- machine or device failure, earthquakes or fires during decommissioning
- (5) Reactor facilities requested to maintain functions, their performance and period to maintain the performance during decommissioning
 - (6) How to dispose of nuclear fuel materials or materials contaminated by these nuclear fuel materials

Abnormal events or accidents are self-focusing during decommissioning, that is, during dismantling of a facility from which spent nuclear fuels or nuclear fuel materials were removed, different from during facility operation. However, when a facility contaminated by radioactive materials is dismantled it is necessary to pay attention to the behavior of contaminated materials. For reactor facilities, in particular, radioactive materials concentrate around the reactor and the assessment of the dismantling methods is important in view of ensuring safety.

It is necessary to assess the distribution of radioactive materials in the facility (inventory assessment) and thus, to assess exposure to the public during dismantling, at normal times, and at the time of an accident in accordance with the amount of these radioactive materials. Since the inventory of radioactivity moves to the filter with construction, it is necessary to maintain facilities, ventilation equipment, radiation management facilities, etc.

Exposure is assessed by referring to the Nuclear Safety Commission guidelines for in-service facilities. Fig. 3 shows an overview of the concept of exposure to the public at normal times.

Regulatory agencies review the decommissioning program for ensuring safety from the standpoint as discussed above. Safety preservation rules of a facility concerned with decommissioning are modified to reflect the decommissioning program and reviewed by regulatory agencies at the same time. After approval of decommissioning and safety preservation rules, the licensee is responsible for management at the stage of implementation based on these safety preservation rules, while regulatory agencies capture the situation during their safety preservation inspection when needed.

At the end of decommissioning, the licensee applies for the verification of the end of decommissioning. The following are verified and decommissioning is completed: implementation situation of dismantling a reactor facility and handover of nuclear fuel materials, removal of contamination caused by nuclear fuel materials (the situation that does not require measures for the prevention of radiation hazards in relation to residual facilities on the site soil and relevant site), and disposal of radioactive wastes.

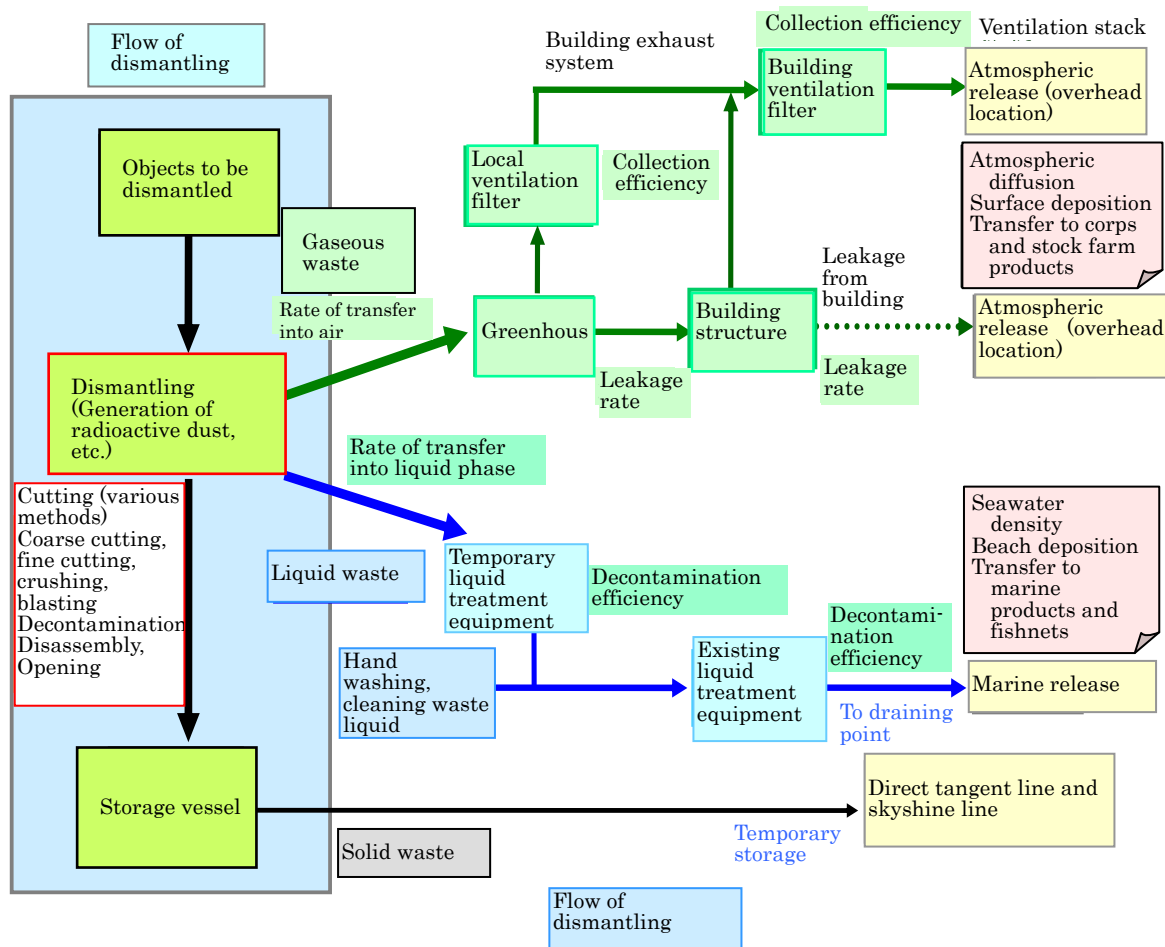


Fig. 3 Overview of exposure assessment during decommissioning

7. Measures for Wastes Arising during Decommissioning

With progress in dismantling of a nuclear power station, a large volume of dismantled wastes is generated with different levels of radioactivity. Since multiple works are intricate, sorting and management become important in limited space within the power station. Thus, it is necessary to implement more proper management than for wastes arising during operation.

In particular, if wastes subject to clearance are taken into account, sorting and management of dismantled wastes are extremely important. The following are particularly important items in waste management during decommissioning.

- Sort wastes by the density and behavior of a radioactive material based on the disposal plan during decommissioning, assess its volume generated and ensure the capacity for temporary storage in advance.

- Make efforts to reduce the volume of wastes generated during the implementation of decommissioning and pay attention to smooth physical distribution.
- Process radioactive wastes properly using appropriate methods that meets the standards for acceptance set up by the destination disposal place, etc. in accordance with their sorting divisions.
- Carry out proper management so that wastes sorted into other classification do not get mixed during processing such as temporary storage, decontamination and vitrification, or packing a vessel.
- Set up management units of wastes and clearly define, for example, the division, volume, processing course, measurement of radioactivity, assessment method, and recording items for systematic history management.

In order to execute these items properly, it is important to determine the items needed for safety reservation rules at each nuclear installation and to ensure their implementation based on the concept of quality assurance. For wastes subject to clearance, particularly, it is necessary to take measures to strictly prevent the mixture of contamination and manage the history and measured records.

Nuclear installations release toxic wastes such as asbestos and PCB. These wastes must be handled in the same way as radioactive wastes to ensure safety.

8. Maintenance Status of Related Documents at IAEA

(1) Document system of safety standards related to decommissioning

The Nuclear Safety Bureau of International Atomic Energy Agency (IAEA) is involved in maintaining the safety requirements and safety guides based on the safety regulation document system with DS298: principles related to safety of nuclear power, radiation, radioactive materials, and transportation, and the basic safety principles of radioactive wastes under development as top.

In particular, the document system of the safety requirements and safety guides under development in relation to decommissioning is as listed in Fig. 4.

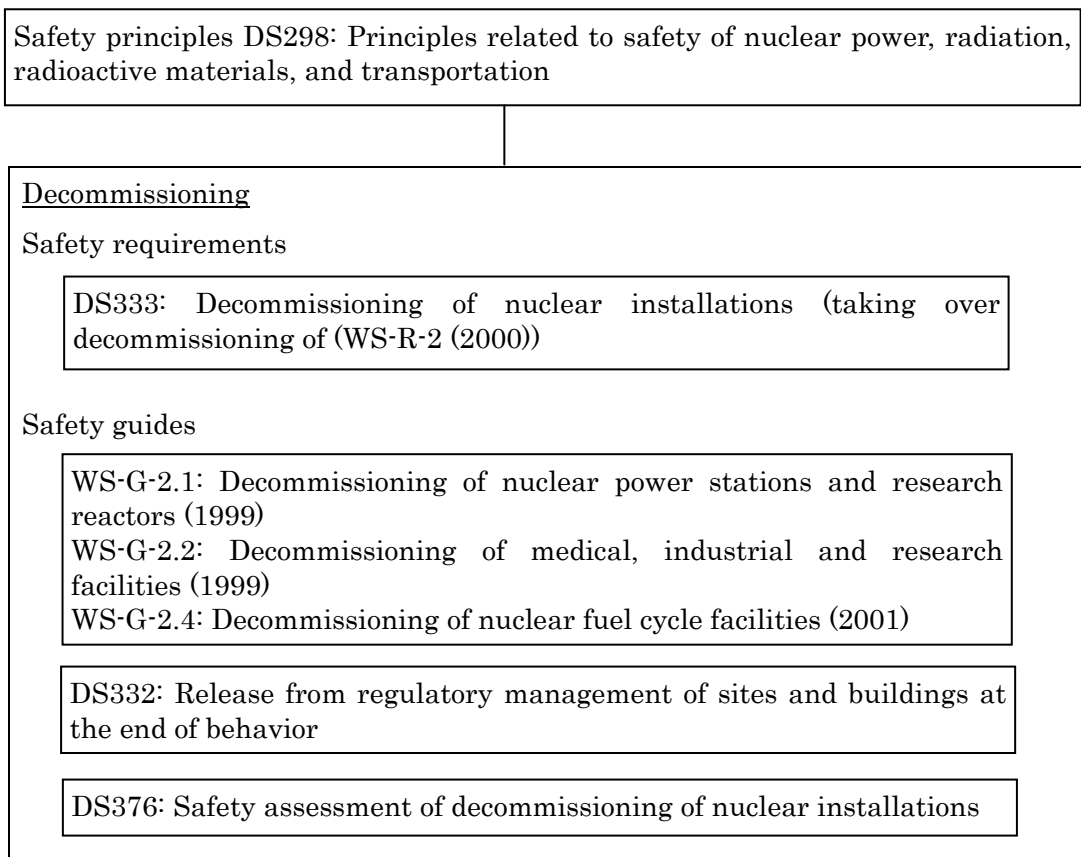


Fig. 4 Document system of safety standards related to decommissioning

(2) Safety requirements: DS333 (Decommissioning of facilities using radioactive materials)

The requirements of decommissioning are contained in the “Management prior to the disposal of radioactive materials including decommissioning” (WS-R-2”), but the part of decommissioning was isolated due to review of WS-R-2. It is predicted that nuclear installations to be decommissioned will be increasing and it is strongly requested that decommissioning will be safely implemented. As a result, this document is now under development.

The latest draft of this document is brought up for discussion to the IAEA Committee on Safety Standards (CSS). The following is a table of comparison between the major contents of the document and the legislative system in Japan.

Table 1 Comparison between DS333 and new legislative system

Item	Major contents	Action in new legislative system
1. Introduction	Background, purpose, scope, organization	All facilities except disposal places under the Nuclear Reactor Regulation Law.
2. Protection of human health and environment	Reference to BSS, exposure, safety culture, environment	The said Law responds to them as general items. Exposure management, safety preservation rules, environmental impact assessment
3. Responsibilities related to decommissioning	Responsibilities of government, regulatory bodies, licensees	The nation develops government ordinances and ministerial orders under the said Law and implements regulations based on them. The licensee implements decommissioning based on the legislative system.
4. Strategy of decommissioning	Higher priority level of immediate dismantling and removal	Atomic Energy Commission assumes immediate dismantling removal as the basis.
5. Decommissioning plan	Concept of developing decommissioning program. Programming from in-service is recommended.	The system assumes an application for the decommissioning program after the end of operation and approves it.
6. Financing	Emphasis on the importance of financing as the system	The financing plan shall be written in the decommissioning program. The reserve fund system is available for commercial reactors.
7. Decommissioning management	Organization, system, education, documented procedure, quality assurance, records, project management, etc.	The decommissioning system shall be written in the decommissioning program. Others are provided by safety preservation rules.
8. Implementation of decommissioning	Ensuring safety during implementation of decommissioning	Written in the decommissioning program. Safety preservation rules shall be provided and safety managed by safety preservation inspection during implementation.
9. Completion of decommissioning	Important items during final verification of decommissioning	The standards of an application for the verification of the end as well as this verification are provided by ministerial orders. Specifically, they will be future issues.

(3) Safety guides: DS376 (safety assessment related to decommissioning of reactor installations)

Much experience has been accumulated with regards to decommissioning, but a systematic approach is required to satisfy safety requirements, etc. Since prior plans related to waste disposal, dismantling, etc. and safety assessment are important, IAEA has started the preparation of a proposed document in order to plan a new safety guide "Safety assessment related to decommissioning of nuclear installations."

At present, DPP (Document Planning Proposal) is open to the public and the draft is now under preparation. The items are as follows:

- Purpose of safety assessment
- Safety assessment as part of comprehensive decommissioning program
- Safety assessment approach (for example, deterministic or stochastic)
- Major stages (for example, definition of assessment frame work, explanation of nuclear installations and decommissioning activities, identification and assessment of the danger, normal and accident scenarios, development of models, calculation of results, or evaluation of result assessment
- Integration of radiological, chemical and industrial dangers
- graded approach to safety assessment
- Use of feedback from experience on decommissioning
- Quality management of safety assessment
- Build-up of reliability of safety assessment and stakeholder involvement
- Safety assessment review and update during the process of decommissioning
- Safety assessment review approach by regulatory agencies or independent organizations

(4) Safety guides: DS332 (Release from regulatory management of sites and buildings at the end of behavior)

Release from has been planed by RS-G-1.7, while the international guidance for release form buildings and sites are planed in this document.

In this document, cleanup activities shall be prepared by the licensee as part of the decommissioning program and documented as the cleanup program approved by regulatory agencies. Taking into account the scale, complexity and potential danger of cleanup, the components of the cleanup program shall provide the following information:

These guides were discussed at the 18th CSS meeting (in November 2005) and approved provided that they will be partly modified. They are under preparation for

publication.

- Investigation of site characteristics (including the site boundary agreed with regulatory agencies)
- Objectives, endpoints, safety principles, and standards of release from cleanup and regulatory management
- Explanation of a proposal for cleanup activities, their equipment, resources, and implementation period
- Explanation of activities for protection of general workers and public
- Proposed activities after site release including information on the use of general data and site specific data, justification reasons of its use, safety assessment of the final condition, and environmental impact assessment
- Explanation of monitoring plan used to demonstrate that the release level was satisfied
- Explanation of measures for radioactive material management
- Explanation of quality management system
- Estimated expenses for the specified cleanup activities as part of decommissioning activities
- Explanation of emergency deployment and response measures
- Explanation of monitoring forecast during and after cleanup

(5) WS-G-2.1, WS-G-2.2 and WS-G-2.4

Three safety guides related to this decommissioning were issued from 1999 to 2001, but they will be possibly reviewed with the establishment of DS33. The new DPP has been prepared for each of them.