Annex 2

Report by the Expert Meeting on Radiological Protection for Disposal Works of Decontamination-Removed Materials

14 February 2013

I. Guidelines for conducting the review meetings and the participants

The guidelines are presented for conducting the expert review meetings on the prevention of radiation hazards for workers engaged in the disposal of decontamination waste such as removed soil and contaminated waste produced with decontamination activities.

1. Objective

It has been decided that the Ordinance on Prevention of Ionizing Radiation Hazards (Ministry of Labour Ordinance No. 41, 1972, hereinafter referred to as "the Ionizing Radiation Ordinance") to be applied to the activities for disposal of the waste contaminated with radioactive materials released from the accident at the TEPCO Fukushima Daiichi Nuclear Power Plant associated with the Great East Japan Earthquake on 11 March 2011 (hereinafter referred to as "radioactive materials discharged by the accident "). With the progress in decontamination, activities such as interim treatment and final disposal of the waste are expected to be undertaken in the future. Under such circumstances, there is an increased need to consider measures to prevent radiation hazards for workers engaged in these activities.

Consequently, the Ministry of Health, Labour and Welfare (MHLW) has invited experts to hold expert meetings regarding proper measures to prevent radiation hazards of workers engaged in the activities for disposal of the waste contaminated with radioactive materials discharged by the accident.

2. Issues considered

(1) Subject facilities

The following facilities for handling waste contaminated with radioactive materials discharged by the accident are covered:

a. Incineration facilities;
b. Crushing (volume reduction and concentration) facilities;
c. Interim storage facilities; and
d. Strictly controlled landfill facilities (final disposal facilities).

(2) Considerations on measures to prevent radiation hazards

The following measures to prevent radiation hazards during the activities such as incineration, crushing (volume reduction and concentration), interim storage, and landfilling of waste contaminated with radioactive materials discharged by the accident are discussed:

a. Limits on external radiation dose rate in the facilities and the radioactivity concentration in air;
b. Method for handling unsealed radioactive material;
c. Structural requirements for facilities;
d. Use of containers;
e. Use of protective equipment;
f. Development of work rules;
g. Implementation of special education;
h. Measurement of working environment; and
i. Other required topics.

3. Constitution

(1) The director of the Occupational Safety and Health Department, Labour Standards Bureau, MHLW invites experts to hold the expert meetings.
(2) The chair is assigned to facilitate discussions in the expert meetings.
(3) Participants in the expert meetings can be added as required.
(4) Individuals other than the expert participants may be invited to participate in the expert meetings.

4. Others

(1) These expert meetings should be basically open to the public. It should be noted, however, that the expert meetings may be closed to the public when discussing matters relate to personal or confidential business information in the meetings.
(2) Administration of the expert meetings are handled by the Industrial Health Division, Occupational Safety and Health Department, Labour Standards Bureau, MHLW.

Participants (in Japanese alphabetical order)

Masahiro Osako	Director, Research Center for Material Cycles and Waste Management, National Institute for Environmental Studies
Nobuyuki Sugiura	Director, Research Center for Radiation Emergency Medicine, National Institute of Radiological Sciences
Shunji Suzuki	Manager, Technical Department, Industrial Waste Foundation
Shunji Nagoya	Professor, Faculty of Science and Engineering, Waseda University
Yoshimi Matsumura	Councilor, Technology Institute of Industrial Safety
Koji Mori	Professor, Occupational Health Training Center, University of Occupational and Environmental Health, Japan
Toshiyuki Monma	Senior Engineer, Fukushima Environmental Safety Center, Headquarters of Fukushima Partnership Operations, Japan Atomic Energy Agency

Observers

Toshihiro Azuma	Deputy Director, Specified Waste Management Team, Waste Management and Recycling Department, Ministry of Environment
Hiroshi Kurumizawa	Deputy Director, Industrial Waste Management Division, Waste Management and Recycling Department, Ministry of Environment (the 1st meeting)
Kazuaki Takahashi	Deputy Director, Office for Recycling Promotion, Waste Management and Recycling Department, Ministry of Environment (the 2nd to 4th meetings)
Tetsuya Nakano	Deputy Director, Policy Planning Division, Environment Management Bureau, Ministry of Environment (the 1st meeting)
Masayoshi Minami	Deputy Director, Industrial Waste Management Division, Waste Management and Recycling Department, Ministry of Environment (the 1st meeting)

II. Schedule of the expert meetings

The 1st **expert** meeting: 4 December 2012

The 2nd **expert** meeting: 25 December 2012

The 3rd **expert** meeting: 15 January 2013

The 4th **expert** meeting: 30 January 2013

III. Matters that need to be incorporated into the measures

Section 1 Objective

It has been decided that the Ordinance on Prevention of Ionizing Radiation Hazards (Ministry of Labour Ordinance No. 41, 1972, hereinafter referred to as "the Ionizing Radiation Ordinance") is to be applied to the activities for disposal of the waste contaminated with radioactive materials discharged by the accident. With the progress in decontamination, etc., activities such as interim treatment and final disposal of the waste are expected to be undertaken in the future. Under such circumstances, the measures to prevent radiation hazards of workers engaged in these activities were discussed in the meetings.

This report provides recommendations on what measures disposal operators should take in order to prevent radiation hazards when assigning workers to activities for disposal of waste contaminated with radioactive materials discharged by the accident, such as exposure dose control, radiation dose limit in facilities and requirements for facilities, actions at workplaces, and actions for health care. These measures include those should be specified in laws and regulations, and those that should be actively used to address issues as guidelines.

Since these measures were developed based on limited information in a limited period of time, additional information and knowledge will continue to be collected to revise the measures as appropriate.

Section 2 Scope of application

1. The measures proposed in this report should be applied to the operators conducting activities involving disposal of objects contaminated with radioactive materials discharged by the accident described in items (1) and (2) below. (Hereinafter the operators, activities, and objects are referred to as the "disposal operator", "accident-derived waste disposal" and "accident-derived waste", respectively.)

   It should be noted that this report excludes the activities falling under "decontamination of soil. etc.", "collection of waste, etc.", "handling of designated contaminated soil and waste." and "works for handling designated contaminated soil and wastes" defined in "the Ordinance on Prevention of Ionizing Radiation Hazards Associated with Actions to Decontaminate Soil and

Wastes Contaminated with Radioactive Materials Resulting from the Great East Japan Earthquake and Related Works" (hereinafter referred to as "the Ionizing Radiation Ordinance for Decontamination").

(1) Soil produced with decontamination actions (including those necessary to remove soil contaminated with radioactive materials discharged by the accident, remove soil attached onto contaminated plants and structures, remove sludge accumulated on fallen leaves and branches or in waterways, prevent spread of contamination, and reduce the influence of other contamination) (for which radioactivity concentrations of cesium-134 and cesium-137 exceed 10,000 Bq/kg; hereinafter referred to as "removed soil").

(2) Waste contaminated with radioactive materials discharged by the accident (for which radioactivity concentrations of esium-134 and cesium-137 exceed 10,000 Bq/kg; hereinafter referred to as "contaminated waste").

(Note) "Radioactive materials" refers to the radioactive materials defined in Article 2, paragraph 2 of the Ionizing Radiation Ordinance.

(Note) The Ionizing Radiation Ordinance for Decontamination covers activities in "special decontamination areas" or " intensive contamination survey areas" which will become a situation in which radiation sources cannot be controlled (existing exposure situation). The measures here, however, should be for the activities for disposing the accident-derived waste that can be handled as a controlled radiation source and from which exposure is dominant (i.e., a planned exposure situation).

(Note) "Disposal" includes final disposal (landfill), interim storage, interim treatment (segregation, crushing, compression, concentration, incineration, etc.), and maintenance and inspection of the relevant facilities and/or equipment.

(Note) Activities for keeping (storing) sludge falling under the accident-derived waste generated at water supply and sewerage treatment facilities and ashes generated by the incineration of municipal or industrial waste which have turned out to exceed 10,000 Bq/kg are not included in the activities to dispose controlled radiation sources. Therefore, these activities are subject to the regulations for storing radioactive materials under the current Ionizing Radiation Ordinance, and not covered by the measures described in this report. Furthermore, the measures in this report do not cover the actions for temporarily storing (keeping) removed soil or contaminated waste that was generated from the decontamination because they are not intended for disposal of controlled radiation sources as well.

2. The following points should be noted to determine whether the measures in this report can be applied to the areas specified in the Ionizing Radiation Ordinance for Decontamination ("special decontamination areas" or "intensive contamination survey areas" specified in the Act on Special

Measures Concerning the Handling of Radioactive Pollution (see note); hereinafter referred to as "special decontamination areas").

(1) "The activities disposing of accident-derived waste" should include collection, transportation, and keeping of accident-derived waste which are conducted as part of the activities disposing of the said waste at disposal sites for the said waste (hereinafter referred to as "disposal sites"), for the main purpose of disposal of the said waste. These activities should not be governed by the Ionizing Radiation Ordinance for Decontamination.

(2) Crushing and segregating accident-derived waste outside the disposal sites, which are conducted as part of "soil decontamination works" and "works for handling designated contaminated soil and wastes" under the Ionizing Radiation Ordinance for decontamination as the primary purpose, are not included in "the activities disposing of accident-derived waste". They are considered as "soil decontamination works" and "works for handling designated contaminated soil and wastes", respectively, and governed by the Ionizing Radiation Ordinance for Decontamination.

(Note) Act on Special Measures Concerning the Handling of Environmental Pollution by Radioactive Materials Discharged by the Nuclear Power Station Accident Associated with the Tohoku District Off the Pacific Ocean Earthquake That Occurred on 11 March 2011 (Law No.110, 2013)

(Note) Posting of signage and setting up fences and the like to prohibit all except those required from entering disposal sites is stated in a separate provision.

Section 3 Methodology for setting radiation controlled areas and exposure dose control

1. General principles

The disposal operators are responsible for ensuring that ionizing radiation doses to workers are as low as reasonably achievable.

(Note) When constructing a disposal site in a special decontamination area, the disposal operators should be required to decontaminate the area around the site in advance in order to reduce radiation dose in the area and assign workers to the activities after reducing radiation dose as low as possible.

2. Clear indication of radiation controlled areas

(1) The disposal operators should post signage to clearly indicate the areas that fall under any of the following criteria (hereinafter referred to as "radiation controlled areas").

a. The areas where the sum of effective doses from external radiation and radioactive material in air may exceed 1.3 mSv per three months.

b. The areas where the surface density of radioactive materials may exceed one-tenth of the surface contamination limit (4 Bq/cm^2).

(2) The disposal operators should prohibit all personnel except those required from entering into the radiation controlled areas.

(Note) The area where the radiation dose may exceed 1.3 mSv per three months should be determined by whether effective dose may exceed 2.5 μSv/h based on the assumption that the number of working hours is 2,000 hours per year.

(Note) The effective dose from external radiation should include that from the environment other than accident-derived waste.

(Note) Although radioactive materials are derived from the accident, one-tenth of the surface contamination limit (4Bq/cm^2) should be conventionally defined for surface contamination under the assumption that the concrete pits inside the disposal sites and other areas inside the sites themselves are in a controlled state. It should be noted that it is necessary to decontaminate the areas inside the sites to reduce contamination to the maximum extent when the disposal sites are constructed in a special decontamination area; this includes the outsides of buildings if they are contaminated with radioactive materials discharged by the accident.

(Note) Details for specifying radiation controlled areas should be subject to the provision in Article 3 of the Ionizing Radiation Ordinance and the Labor Standards Bureau Notification No.253 as of 30 March 2001.

3. Measurement of radiation dose

(1) The disposal operators should measure the radiation doses of external and internal exposures to the workers carrying out the accident-derived waste disposal in a radiation controlled area (hereinafter referred to as "workers for accident-derived waste disposal).

a. External exposure should be measured by attaching a radiation measuring instrument, as specified in the Ionizing Radiation Ordinance.

b. Committed dose should be measured by using the method specified in the Ionizing Radiation Ordinance once within every three months for those who enter the places in radiation controlled areas where they may intake radioactive materials by inhalation or ingestion.

(2) External exposure should be measured by attaching radiation measuring equipment on the following body parts.

a. Chest for men, or women who were diagnosed with no possibility of pregnancy, and

abdomen for other women.

b. The body part that may be exposed to the highest radiation.

(3) Internal exposure should be measured by using the method specified in the Ionizing Radiation Ordinance.

(Note) Other details should be subject to the provisions in Articles 8 and 9 of the Ionizing Radiation Ordinance.

(Note) Exposure in radiation controlled areas should be evaluated by adding the exposure from accident-derived waste and other sources altogether.

(Note) Basically it is sufficient for workers to attach personal dosimeters at the parts specified in (2)-a., because cesium-134 and cesium-137 are the dominant radiation sources of radioactive materials discharged by the accident and because there are no radiation beam sources. It should be noted, however, that workers are required to attach ring badges on their hands as well as wear instruments on their chests that can measure beta rays (70μm dose equivalent) to monitor the equivalent dose, because beta rays may become the dominant exposure source when workers are engaged in treatment for removing cesium-134 and cesium-137 from waste and handling the post-treatment waste liquid.

(Note) "The places where one may intake radioactive materials by inhalation or ingestion", which are the target for internal exposure measurement, should refer to the places where the surface density of radioactive material may exceed one-tenth of the surface contamination limit (4 Bq/cm^2), or those where the concentration of airborne radioactive materials may exceed one-tenth of the airborne concentration limit.

(Note) The disposal site operator should be required to give due consideration that a sufficient number of whole body counters are prepared according to the number of the target individuals for measuring internal exposure.

4. Radiation Exposure dose limit

(1) The disposal operators should prevent the total effective dose that a worker engaged in accident-derived waste disposal receives from exceeding the following limits.

a. For men or women who were diagnosed with no possibility of pregnancy, the dose should not exceed 100 mSv in 5 years and 50 mSv in one year.

b. For women except those who were diagnosed with no possibility of pregnancy and those described in c., the dose should not exceed 5 mSv per three months.

c. For women who were diagnosed with pregnancy, the effective dose from internal exposure should not exceed 1 mSv, and the equivalent dose received on the surface of their abdomen should not exceed 2 mSv during pregnancy.

(2) The disposal operators should ensure that the equivalent doses received at the eye lens and skin of a worker engaged in accident-derived waste disposal does not exceed 150 mSv/y

and 500 mSv/y, respectively.

(3) The disposal operators should ensure that the doses of men or women who were diagnosed with no possibility of pregnancy do not exceed each limit specified among the following categories, when conducting emergency work to protect workers from radiation hazards in case of an accident (hereinafter referred to as "emergency work").

a. Effective dose: 100 mSv

b. Equivalent dose received at the eye lens: 300 mSv

c. Equivalent dose received at the skin: 1 Sv

(Note) Details for the effective dose limit, equivalent dose limit, and exposure limit during emergency work should be the same as those in provisions in Articles 4 to 7 of the Ionizing Radiation Ordinance.

(Note) The exposure dose should be controlled so as not to exceed its limit even by adding those from the radiation work, decontamination work, and specified high radiation dose work altogether.

5. Recording dose measurement results

(1) The disposal operators should determine radiation exposure doses of the following workers based on the measurement results in 3 by using the method specified in the Ionizing Radiation Ordinance, and record and keep them for 30 years. It should be noted however, that this should not apply when the records are transferred to the organization designated by the Minister of Health, Labour and Welfare after keeping for 5 years.

a. The sum of every three months, every year, and every 5 years of the effective doses for men or women who were diagnosed with no possibility of pregnancy (the sum of every three months and every year for those whose annual effective doses have not exceeded 20 mSv for 5 years).

b. The sum of every month, every three months and every year of the effective doses for women who were diagnosed with the possibility of pregnancy (the sum of every three months and every year for those whose monthly effective doses have not exceeded 1.7 mSv for a month).

c. The sums of effective dose from internal exposure and equivalent dose that a pregnant woman receives on the surface of her abdomen in every month and during pregnancy

(2) The disposal operators should notify workers of the records regarding (1) without delay.

(3) The disposal operators should transfer the records stated in (1) to the organization designated by the Minister of Health, Labour and Welfare when terminating its business.

(Note) Details should be subject to the provisions in Article 9 of the Ionizing Radiation Ordinance.

(Note) As the employment period of the workers engaged in waste disposal is expected to be longer than that of those engaged in decontamination work, no provision will be specified with respect to issuing a copy of the record when a worker leaves his job, as with the current Ionizing Radiation Ordinance.

Section 4 Dose limit at facilities

1. Dose limit at facilities

It should be ensured that the sum of the effective dose from external radiation at the places where workers constantly access and the effective dose from radioactive materials in air does not exceed 1 mSv per week, by setting up shielding, a local ventilation system, and an air-tight system in the facilities dedicated to handle unsealed accident-derived waste (hereinafter referred to as "accident-derived waste handling facilities"), in the storage facilities, and in the facilities for burying accident-derived waste (hereinafter referred to as "landfill facilities").

(Note) 1mSv per week should mean 25 μSv/h under the assumption that the number of work hours is 40 hours per week.

(Note) In order not to exceed 1 mSv per week, at least the concentration of radioactive materials in air should be required to be equal to or less than the concentration limit in air (corresponding to approx. 50 mSv per year).

(Note) In the case of constructing a facility for handling accident-derived waste in a special decontamination area, it is necessary to take actions such as using remote-operated construction vehicles and vehicles with shielding, in order not to exceed 25 μSv/h at the places where workers constantly access and where it is hard to maintain the criterion on the effective dose because the nature of the work makes it difficult to set shields.

(Note) The radiation dose limit should be specified for the places where workers constantly access. This limit should not be applied when workers enter an incinerator and/or crushing, classification, compression, and concentration systems to conduct non-routine work including maintenance and inspection.

2. Surface contamination limit in facilities

The disposal operators should inspect ceilings, floors, walls and equipment (only where workers may touch) in accident-derived waste handling facilities once within every month. If there is contamination the operators should remove it to the level of the limit (40 Bq/kg) or less.

(Note) No contamination inspection should be required for the parts where workers are unlikely to touch during

their regular work, including ceilings and walls that are too high for workers to reach over to touch.

(Note) One or two portions which may possibly be the most contaminated should be selected for each surface of a wall or equipment for the measurement.

3. The concentration of airborne radioactive materials outside of the facilities for handling accident-derived waste

The weekly average concentration over three months should be maintained at one-tenth of the airborne concentration limit (corresponding to approx. 5mSv/y) or below in the sites except the accident-derived waste handling facilities, work rooms for handling radioactive materials and tunnels where nuclear materials are mined.

4. Measures against spillage of radioactive materials outside the accident-derived waste handling facilities

In the case that radioactive materials discharged by the accident are spilled at a place other than the accident-derived waste handling facilities, measures should be taken to prevent spread of contamination, to indicate clearly the contaminated zone, and to remove the radioactive materials to the level of one-tenth of the surface contamination limit (4 Bq/cm^2) or below.

5. Measurement of working environment

For the working environment, the following items should be measured in radiation controlled areas and accident-derived waste handling facilities, records should be kept for 5 years, and the results should be posted at an easily visible place.

a. Radiation controlled area: dose equivalent rate or dose equivalent
b. Accident-derived waste handling facilities: concentration of radioactive materials in air

(Note) Dose equivalent rate or dose equivalent in radiation controlled areas should be measured by using the methods specified in Articles 7 and 8 of the current working environment measurement standards (Notification of the Ministry of Labor No.46, 1976) and the relevant circular notice (Labour Standards Bureau Notification No.253, as of 30 March 2001).

(Note) Simplified methods for measuring the concentration of airborne radioactive materials should be studied in addition to those specified in Article 9 of the current working environment measurement standards and relevant circular notice (Labour Standards Bureau Notification No.253, as of 30 March 2001).

(Note) As with the current provision, the provision should specify that the concentration of airborne radioactive

materials specified in b should be measured by a working environment measurement expert.

Section 5 Requirements for equipment used to prevent contamination

1. Construction of fences at disposal site borders

(1) The disposal operators should clearly indicate the borders of the disposal site by posting signage and constructing fences, etc.

(Note) In order to protect personnel not related to the disposal from being exposed to accident-derived waste, fences need to be constructed at the borders of the area where activities for accident-derived waste disposal are conducted (i.e., disposal sites), not at the borders of radiation controlled areas. It should be noted, however, that a narrower border of a disposal site than the actual site border is acceptable to confine the work area. Fences, etc. are not limited to full-fledged fixed fences and the like, but may include safety cones.

2. Accident-derived waste handling facilities

(1) The disposal operators should build a facility designated for the work handling accident-derived waste when handling unsealed waste, and conduct the work within the facility.

(2) The disposal operators should conform to the following requirements with respect to the ceilings, walls, floors, and other parts that may possibly be contaminated which are located inside of the accident-derived waste handling facility.

a. The parts should be made of material with low gas or liquid permeability and with corrosion resistance.
b. Surfaces should be finished smoothly.
c. Structures should have as few as possible projections, pits, or gaps.

(3) In addition to (2), the disposal operators should take the following actions according to the accident-derived waste to be handled to prevent dust or liquid generated after the handling process from leaking outside of the accident-derived waste handling facility.

a. Handle accident-derived waste that may generate liquid contaminated with radioactive materials in a facility whose structure has no potential leakage of liquid and which is made of corrosion-resistant material with low liquid permeability.
b. Take measures to prevent dust dispersion when handling accident-derived waste that may disperse dust contaminated with radioactive materials.

(4) The disposals operator should take measures to prevent spread of contamination at entrances and exits of accident-derived waste handling facilities, such as by building double-entry doors.

(5) The disposal operators should post signage indicating the accident-derived waste handling facility at the entrance and exit of the facility and prohibit all except those required from

entering.

(Note) A provision should specify that the materials, surface finishes, and structural designs to facilitate removal of contamination (easy to decontaminate) are required to be durable enough to withstand operations as trucks and construction vehicles.

(Note) No provision is specified regarding the gaseous state of radiocesium, the dominant nuclide in accident-derived waste. As the element, its boiling point is 690 deg C and as cesium chloride it is 1,300 deg C, and the vapor pressure is extremely low at normal temperatures (estimated as 2.75 *x 10^{-12} Pa at 150 deg C).

(Note) The highest dust concentration in facilities for interim treatment and incineration is approximately 15 mg/m^3 (See Material No.7 of the 2nd meeting); the highest radioactivity concentrations of waste are approximately 100,000 Bq/kg and 2,000,000 Bq/kg before and after incineration, respectively (See Material No.3 of the 2nd meeting); and multiplying the highest dust concentration by the highest radioactivity concentration gives the assumed maximum dust concentration of approximately 30 Bq/m^3. In contrast, the airborne radioactivity concentration limits specified in the attached Table 1 of the Ionizing Radiation Ordinance are 2,000 Bq/m^3 and 3,000 Bq/m^3 for cesium-134 and cesium-137, respectively. Thus, as for dust, it is expected that one-tenth of the airborne radioactivity concentration limit outside of the facilities can be guaranteed even if they are not completely sealed. Therefore, in addition to enclosing facilities, the measures to prevent dust from being generated include installing a local ventilation system (with a dust collector) upon ensuring that the structural design has as few as possible gaps in ceilings and walls, and spraying water to the extent that water does not need to be discharged.

(Note) The accident-derived waste handling facilities have large opening sections to allow entry/exit of trucks. This requires double-entry doors in order to prevent the opening sections from being kept open during the entry/exit of trucks. It is also necessary to inspect contamination between the double-entry doors in order to prevent spread of contamination to the near-by facilities. It should be noted that the double-entry doors are not necessarily actual doors. It is acceptable to use other measures such as water shielding sheets which are made of material that can prevent spread of contamination and which are possible to open and close. The facility where the double-entry doors will be set is not necessarily a rigid building as well, i.e., temporary tents are acceptable.

(Note) The meaning of the double-entry doors includes the function to sustain air flow in the direction from the outside to the inside of the facility, as controlled by exhaust ventilation systems when the opening sections are kept open.

3. Equipment for crushing, segregating, compressing, and concentrating accident-derived waste

(1) When using machines for crushing, segregating, compressing, and concentrating accident-derived waste (hereinafter referred to as "crushing equipment"), the disposal operators should ensure that such equipment conforms to the following provisions.
It should be noted, however, that this should not be applied when such crushing equipment is installed inside the facility for handling accident-derived waste.

a. Accident-derived waste that may generate liquid contaminated with radioactive materials should be handled in crushing equipment for which there is no structural possibility of leakage of liquid and which is made of corrosion-resistant materials with low liquid permeability.
b. Accident-derived waste that may generate dust or gas contaminated with radioactive materials should be handled in crushing equipment with a structure resistant to dust dispersion and gas leakage.

(2) The disposal operators should post appropriate signage outside the crushing equipment in an easily visible place.

(Note) "Crushing equipment" includes accessory pipes and joints.

(Note) "No potential dust dispersion" and "no potential gas leakage" should mean that the equipment is required to have no possibilities of dust dispersion or gas leakage from the parts other than the supply and exhaust ventilation systems. "No possible liquid leakage" should mean that there are no possibilities of liquid leakage from the parts other than the water supply and drainage system.

(Note) The purpose of the regulation should be to maintain sealing ability of the equipment to prevent workers from being exposed to accident-derived waste. Therefore, for the case that the equipment does not have sufficient sealing ability and that dust spreads in the vicinity of the equipment, the crushing equipment should be required to be placed in an accident-derived waste handling facility as stated in Section 2, Part 3.

4. Incinerators

(1) The disposal operators should incinerate accident-derived waste using incinerators with a structure that has no possibilities of gas leakage and ash dispersion.

(2) The disposal operators should post appropriate signage outside the incinerator in an easily visible place.

(Note) "Incinerator" includes accessory pipes and joints.

(Note) "No possible gas leakage" means that the incinerator is required to have no possibilities of contaminated gas leakage from the parts other than the supply and exhaust ventilation systems.

5. Facilities for burying accident-derived waste

(1) The disposal operators should bury accident-derived waste at a landfill facility which is separated from the outside environment and which has keys and other equipment or apparatuses to shut doors, lids and other parts connected to the outside environment.

(2) The disposal operators should bury unsealed accident-derived waste at a facility that falls under the accident-derived waste handling facilities, and that meets the requirements specified in Section 2.

(3) The disposal operators should post signage outside the facility and construct fences and the like to prohibit all except those required from access.

(Note) Landfill includes the cases that removed soil or contaminated waste generated from decontamination is landfilled for interim storage. Other storage methods should be governed by storage regulations.

(Note) The highest dust concentration during decontamination work is approximately 15 mg/m^3 (See Material No.7 of the 2nd meeting); the highest radioactivity concentrations of accident-derived waste are approximately 100,000 Bq/kg and 2,000,000 Bq/kg before and after incineration, respectively (See Material No.3 of the 2nd meeting); and multiplying the highest dust concentration by the highest radioactivity concentration gives the assumed maximum dust concentration of approximately 30Bq/m^3. In contrast, the airborne radioactivity concentration limits specified in the attached Table 1 of the Ionizing Radiation Ordinance are 2,000 Bq/m^3 and 3,000 Bq/m^3 for cesium-134 and cesium-137, respectively. When removed soil without being sealed is landfilled, the work is not necessarily required to be conducted in a strictly sealed area in order to guarantee one-tenth of the airborne radioactivity concentration limit outside of the facility. Only dumping work should be done in a mobile temporary tent or other location surrounded by a ceiling and walls. Once the removed soil is covered by uncontaminated soil, the temporary tent may be transferred to another place.

This case should require a concrete pit or sealing lining as the floor surface to prevent spread of contamination.

6. Storage Facilities

(1) The disposal operators should store accident-derived waste at a storage facility which is separated from the outside environment and which has keys and other equipment to shut doors, lids and other parts connected to the outside environment.

(2) The disposal operators should post appropriate signage outside the storage facility in an easily visible place.

7. Facilities for ventilation or discharging liquid

(1) When leading, storing, or cleaning waste gas or liquid from accident-derived waste handling facilities, the disposal operators should use a facility for which the structure has no possible leakage of waste gas or liquid and which is made of corrosion-resistant materials with low liquid permeability.

(Note) Accident-derived waste handling facilities include crushing equipment, incinerators, storage facilities, and landfill facilities equipped with local ventilation systems.

(Note) Exhaust systems include local ventilation systems, dust collectors (bag filters), and accessory pipes.

8. Belt conveyors

(1) When transporting unsealed accident-derived waste, the disposal operator should use belt conveyors whose structure has no possible dust dispersion or leakage of gas or liquid and which are made of corrosion-resistant materials with low permeability, according to the nature of the waste to be transported by using such measures as covers.

(Note) Accident-derived waste handling facilities include crushing equipment, incinerators, storage facilities, and landfill facilities equipped with local ventilation systems.

(Note) The cover used for a belt conveyor should be able to cover the four planes around the belt conveyor including the bottom plane, in order to prevent dust dispersion. It should be noted that the meaning of covering the belt conveyor includes installing it in close contact with the floor or the base.

9. Actions for maintenance

(1) Before opening access doors for maintenance or inspection of equipment or facilities, the disposal operators should take measures to prevent spread of contamination such as by covering with water shielding sheets. In addition, before conducting activities such as replacement of ventilation filters that may spread contamination over a wide area, the disposal operators should take measures to prevent spread of contamination such as by setting temporary tents and/or using a local ventilation system.

(2) The disposal operators should provide the protective equipment specified in Section 6 for workers to wear and use during maintenance and inspection tasks.

(3) The disposal operators should inspect contamination around the opening after the tasks, and decontaminate it to the level below one-tenth of the surface contamination limit (4 Bq/cm^2).

Section 6 Measures for preventing contamination

1. Containers

(1) The disposal operators should use containers for keeping, storing, transporting, or burying accident-derived waste.

(2) It should be noted however that this should not be applied when effective measures are taken to shield external radiation or prevent spread of contamination from waste which is extremely difficult to put in containers, when such waste is handled within an accident-derived waste handling facility, or when such waste is transported using belt conveyors and other transportation equipment which have been already protected by measures to prevent spread of contamination.

(Note) Structure of the containers should be subject to the provisions in Article 37 of the Ionizing Radiation Ordinance.

(Note) "Waste which is extremely difficult to put in containers" includes large machines, and cut trees, dismantled structures and other items larger than the container capacity.

(Note) "Effective measures to prevent spread of contamination" includes actions such as wrapping with plastic sheets.

(Note) When accident-derived waste is landfilled without containers and being sealed, the landfilling work should be conducted in an accident-derived waste handling facility.

2. Contamination inspection

(1) The disposal operators should prepare a suitable contamination inspection place at the exit of the accident-derived waste handling facility and other facilities that may be contaminated in excess of one-tenth of the surface contamination limit (4 Bq/cm^2), and check the contamination levels of workers' bodies and their clothing when they exit the facility.

(2) When the inspection result shows that a worker's contamination level exceeds one-tenth of the surface contamination limit (4 Bq/cm^2), the disposal operators should make him or her stay in the radiation controlled area until the following actions are taken.

a. The contaminated body should be washed until the contamination level falls to the surface contamination limit or below.

b. The contaminated outfit should be taken off or the contaminated equipment removed.

(3) The disposal operators should prepare a suitable contamination inspection place at the exit of the accident-derived waste handling facility and other facilities that may be contaminated in excess of one-tenth of the surface contamination limit (4 Bq/cm^2), and check the contamination levels of items when they are taken out of the facility. It should be noted,

however, that this should not be applied when such items are transported using belt conveyors and others on which measures have been already taken to prevent spread of contamination.

(4) When the inspection result shows that the contamination level of the item exceeds one-tenth of the surface contamination limit (4 Bq/cm^2), the item should not be taken from the facility. It should be noted however, that this should not be applied when such items are transported to the facilities for removing contamination, or for disposing of accident-derived waste after measures were taken to prevent spread of contamination such as by putting them in a container.

(Note) It is presumed that the contamination inspection for vehicles is conducted inside of a temporary tent with double-entry doors.

3. Tools for handling radioactive materials

(1) The disposal operators should put labels on tools indicating that they are used to handle accident-derived waste, and also should not use them for other purposes. These tools should be kept using hooks and/or shelves with structures and materials whose contamination can be easily removed.

4. Protective equipment

(1) Respiratory protective equipment

a. The disposal operator should prepare effective respiratory protective equipment to be used by workers engaged in prearranged or emergency work in the accident-derived waste handling facilities or areas where accident-derived waste may be spilled, or inside of the incinerators where workers may access for maintenance work, when they may inhale air exceeding the concentration limit of airborne radioactive materials (approx. 50 mSv per year).

b. The effective respiratory protective equipment should include the respirators with dust collection efficiencies corresponding to the following categories for the works and radioactivity concentrations of accident-derived waste, or those with equivalent or better dust collection efficiencies.

	Radioactivity Concentration above 2,000,000 Bq/kg	Radioactivity Concentration above 500,000 Bq/kg to 2,000,000 Bq/kg	Radioactivity Concentration 500,000 Bq/kg or below
Work under high levels of dust concentration (where the dust concentration exceeds 10 mg/m^3)	Dust collection efficiency: ≥ 99.9% (full face mask)	Dust collection efficiency: ≥ 95%	Dust collection efficiency: ≥ 80%
Work other than that under high levels of dust concentration (dust concentration: 10 mg/m^3 or below)	Dust collection efficiency: ≥ 95%	Dust collection efficiency: ≥ 80%	Dust collection efficiency: ≥80%

(Note) Three types of dust collection efficiencies of the respirators: 99.9% or above (RS3/RL3), 95% or above (RS2/RL2), and 80% or above (RS1/RL1).

(Note) The protection coefficients are 50 for the full-face type of RS3/RL3, 10 for the half-face type of RS3/RL3, 14.3 for the full-face type of RS2/RL2, 6.7 for half-face type of RS2/RL2, 3.3 for half-face type of RS1/RL1 (See reference material 6.) The levels of the respirators are selected based on the required protection coefficients, defining the annual control limit of internal exposure as 1 mSv. See reference material 8 for the required protection coefficients according to dust concentration and radioactivity concentration.

(Note) The respirator filter should be the RL type when liquid is handled. It is required to wear a gas mask with the protection function against dust (e.g., charcoal filter respirator) suitable for the type of gas, when gaseous radioactive materials are handled.

(2) Protective clothing

a. The disposal operators should prepare effective protective clothing, gloves, or shoes to be used by workers engaged in the activities that may exceed one-tenth of the surface contamination limit (4 Bq/cm^2).

b. The disposal operators should prepare dedicated work clothes to be used by workers engaged in the activities in accident-derived waste handling facilities.

c. The effective protective clothing, gloves, or shoes should include those corresponding to the following categories for dust concentrations and radioactivity concentrations of accident-derived waste, or those with the equivalent or better protective efficiencies.

	Radioactivity Concentration above 2,000,000 Bq/kg	Radioactivity Concentration above 500,000 Bq/kg to 2,000,000 Bq/kg	Radioactivity Concentration 500,000 Bq/kg or below
Dust concentration above 10 mg/m^3	Two-ply air-tight chemical protective suit worn over a long sleeve shirt, two-ply rubber gloves worn over cotton gloves, rubber boots	Air-tight chemical protective suit worn over a long sleeve shirt, rubber gloves worn over cotton gloves, rubber boots	A long sleeve shirt, cotton gloves, and rubber boots
Dust concentration 10mg/m^3 or below	Air-tight chemical protective suit worn over a long sleeve shirt, rubber gloves worn over cotton gloves, rubber boots	A long sleeve shirt, rubber gloves worn over cotton gloves, and rubber boots	A long sleeve shirt, cotton gloves, and rubber boots

(Note) When it is expected that, during maintenance work inside the facility, the entire body will be contaminated with radioactive material exceeding the radioactivity concentration of 2,000,000 Bq/kg, it should be recommended to use a positive-pressure type or airtight full body chemical protective clothing (e.g., air-tight Tyvek suit).

(Note) When handling liquids contaminated with radioactive materials discharged by the accident such as treating contaminated water, workers should wear waterproof clothing with a hood, which separates into upper and lower parts, on their protective clothing.

(3) The following descriptions should be noted when determining radioactivity concentration and dust concentration of accident-derived waste.

a. See Attachment 1 to determine which category radioactivity concentration falls under.

b. See the following statements to determine whether the work corresponds to high-concentration dust work.

(i) The activities handling dried accident-derived waste that is not sealed in containers and the activities that require workers to enter inside equipment for incineration, segregation, crushing, compression, and concentration of accident-derived waste should be considered as the work exceeding a dust concentration of 10 mg/m^3 and appropriate protective equipment should be selected.

(ii) Regardless of (i), when measuring dust concentration during work, determine whether it falls under the work at high levels of dust concentration based on the measurement results. See Annex 2 for the determination method with the measurements.

(4) When it has been found that respiratory protective equipment or protective clothing to be used by workers are contaminated in excess of the contamination limit, the disposal operators

should not provide them such equipment unless the contamination is washed off in advance to reduce the contamination level to the limit or below.

5. Prohibition of smoking, eating and drinking

The disposal operator should prohibit workers from smoking, drinking and eating in a facility for handling accident-derived waste and any other workplaces where they may intake radioactive materials by inhalation or ingestion, and put notices of the prohibition in visible locations. Workers should not smoke, drink or eat in such workplaces.

Section 7 Work management

1. Work rules for the activities of accident-derived waste disposal

(1) The disposal operators should define rules concerning the following items related to the activities of accident-derived waste disposal, follow them in conducting the activities, and disseminate them to the involved workers.

a. Operation in or of accident-derived waste handling facilities, crushing equipment, incinerators, storage facilities, landfilling facilities, exhaust ventilation and liquid discharge facilities, and equipment related to belt conveyors and others.
b. Adjustment of safety equipment and automatic alarming equipment
c. Method and procedures for activities
d. Actions for monitoring external radiation and airborne radioactive materials
e. Actions related to inspection of contamination levels of ceilings, floors, walls and equipment, and removal of the contamination.
f. Emergency actions in case of abnormal events
g. Other necessary actions

Section 8 Emergency actions

1. Evacuation in case of accidents

(1) In case of an accident that falls under any of the events below, the disposal operators should use signage to clearly indicate the area where the effective dose due to the accident may exceed 15 mSv, prohibit access except by emergency workers, and report to the Labour Standard Supervision Office within the jurisdiction on the accident.

a. Shielding objects were damaged.
b. Failure or damage of local exhaust ventilation systems or the equipment that seals the source of radiation leading to loss of their functions.
c. A large volume of radioactive materials is leaked, spilled, or scattered.
d. Any other unexpected events occurred.

(2) In case any of the accidents stated in (1) occurs, the disposal operators should record the accident-derived effective dose and details of the accident, and keep them for 5 years.

2. Medical doctor's diagnosis

(1) The disposal operators should immediately provide a worker who falls under any of the

following categories with a medical examination or treatment by a medical doctor, and report it to the head of the Labour Standard Supervision Office.

a. Workers who were in the area stated in 1 (1) when any of the accidents stated in 1 (1) occurred.
b. Workers whose exposure doses exceeded their exposure limit.
c. Workers who inhaled or ingested radioactive materials by accident.
d. Workers unable to reduce the contamination to the surface contamination limit (4 Bq/kg) or below by washing their body.
e. Workers whose injury parts were contaminated.

(Note) Category c is limited to those cases expected to receive a certain level of internal exposure, such as when a worker was buried under accident-derived waste due to a workplace accident, and when a large volume of accident-derived waste or other objects contaminated with the waste entered through the worker's mouth.

Section 9 Education for workers

1. Special education for workers

(1) The disposal operators should provide workers with special education on the following courses before assigning them any activities for accident-derived waste disposal.

a. Influence of ionizing radiation on living organisms and the exposure dose control method (1 hour lecture)
b. How to dispose of accident-derived waste (1 hour lecture)
c. The structure of the equipment used for accident-derived waste disposal and how to handle it (1 hour lecture)
d. Relevant laws and regulations (1 hour lecture)
e. How to dispose of accident-derived waste and handle the equipment used for the work (1.5 hour training)

(2) Follow Annex 3 for details on the implementation of education.

(Note) The lectures regarding b and c are determined to be 1 hour each because many of the workers receive the special education regarding the activities in waste incineration facilities, specified in Article 592-7 of the Ordinance on Industrial Safety and Health (Ministry of Labour Ordinance No. 32, 1972).

(Note) It was judged to be sufficient to provide education only regarding the activities that workers will be engaged in because disposal activities vary from landfilling to crushing.

Section 10 Actions for health care

1. Special medical examinations

(1) The disposal operators should provide full-time workers for accident-derived waste disposal with medical examinations on the following items by medical doctors at the time of employment or being transferred to the work, and once within every 6 months thereafter on a regular basis.

a. Investigation and evaluation on whether workers have exposure histories
b. White blood cell count and its differential counts
c. Red blood cell count and hemoglobin content test or hematocrit test
d. Cataract eye test
e. Skin test

(2) Of the medical examinations stated in (1), which are provided on a regular basis, a worker should be able to skip all or part of the tests stated in the items b to e if a medical doctor considers that they are not necessary.

(3) Regardless of the provision in (1), the tests stated in the items b to e will be unnecessary if a medical doctor considers so, for a worker whose medical examination (provided on a regular basis) of the previous year shows that his/her effective dose was equal to or below 5mSv and whose effective dose of the present year is unlikely to exceed 5mSv.

(4) The disposal operators should prepare medical examination records based on the medical examination results and keep them for 30 years. It should be noted however, that this should not apply when the records are transferred to the organization designated by the Minister of Health, Labour and Welfare after keeping them for 5 years.

(5) The disposal operators should transfer the medical examination records to the organization designated by the Minister of Health, Labour and Welfare when intending to terminate its business.

(6) Collecting medical doctors' opinion regarding the medical examination results (as with the conventional Ionizing Radiation Ordinance)

(7) Notification of the medical examination results (as with the conventional Ionizing Radiation Ordinance)

2. General medical examination

(1) The disposal operators should provide full-time workers for accident-derived waste disposal with general medical examinations by a medical doctor at the time of employment or being transferred to the work, and once within every 6 months thereafter on a regular basis.

< The items should be the same as those specified in Article 44, Periodical Medical

Examination of the Ordinance on Industrial Safety and Health. >

(2) Criteria for skipping medical examination items (Article 45, the Ordinance on Industrial Safety and Health)

(3) Preparation and 5-year keeping of medical examination records (Article 51, the Ordinance on Industrial Safety and Health)

3. Subsequent actions

(1) Collecting medical doctor's opinion regarding the medical examination results (as with the conventional Ionizing Radiation Ordinance)

(2) Notification of the medical examination results (as with the conventional Ionizing Radiation Ordinance)

(3) Report on the medical examination results (as with the conventional Ionizing Radiation Ordinance)

(4) Actions based on the medical examination results (as with the conventional Ionizing Radiation Ordinance)

Section 11 Safety and health management system

1. Tasks of facility management operators

(1) The facility management operator (facility owner) should implement the following tasks.

a. Establishing councils for involved operators

b. Management of systems for their maintenance and repair

c. Tasks described in 2 and 3 below, for establishing the safety and health management system of relevant subcontractors (contracted operators) including workers when the principal contractor is the facility management operator during normal operations

d. Tasks specified in 4 for workers of the facility management operator

(2) The facility operator (e.g., contractor commissioned to conduct all or part of the operations management in the facility) and the facility maintenance operator (e.g., contractor commissioned to conduct all or part of the maintenance management in the facility) should implement the following tasks.

a. Tasks specified in 2 and 3, for establishing the safety and health management system of relevant subcontractors (contracted operators) including workers when the primary contractor is responsible for operations management during normal operations

b. Tasks specified in 2 and 3 for regular inspections and repair, when the primary contractor is responsible for maintenance management

c. Tasks specified in 4 for workers of the facility operator

2. Establishment of safety and health management system by primary contractors

(1) Assigning general safety and health manager

The primary contractor involved in accident-derived waste disposal should assign a general safety and health manager among the individuals who supervise and manage the activities of accident-derived waste disposal to perform the following tasks (2) to (4) in order to ensure that the safety and health management is implemented in an appropriate manner.

(2) Assigning the person in charge for safety and health management in relevant subcontractors

The general safety and health manager assigned by the primary contractor should let the relevant subcontractor assign the person in charge for safety and health management and let him/her perform the following tasks.

a. Contacting with the general safety and health manager assigned by the primary contractor

b. Coordination with the general safety and health manager assigned by the primary contractor to facilitate the following tasks relevant to the relevant subcontractor

c. Contacting and coordinating tasks with all of the other relevant subcontractors when the involved subcontractor assigns part of its business to other relevant subcontractors

(3) Holding safety and health coordinating meetings including all of the relevant subcontractors

a. Establish an organization for safety and health coordinating meeting including all of the relevant subcontractors, and hold meetings once within a month on a regular basis.

b. The organization should discuss the following matters.

(i) Implementation of necessary safety and health education including special education for workers who will be newly engaged in the activities for accident-derived waste disposal

(ii) Development and improvement of work rules

(iii) Establishing the place for contamination inspection and implementing contamination inspection

(iv) Communication and emergency actions in case of abnormal events including occupational hazards

(4) Guidance and support for developing work rules

a. The general safety and health manager assigned by the primary contractor should guide or support the relevant subcontractors as necessary to ensure that the contents of their work rules are appropriate.

b. The general safety and health manager assigned by the primary contractor should guide or support relevant subcontractors to ensure that the relevant subcontractors inform their workers of the contents of the work rules in an appropriate manner.

3. Consolidated management of exposure status by primary contractors

(1) The primary contractor engaged in accident-derived waste disposal should assign a radiation administrator to consolidate the management of workers' radiation exposure doses including those of the relevant subcontractors. It is recommended that a radiation administrator be selected among those with radiation-related national qualifications or those trained through courses regarding radiation control at professional education organizations.

(2) The primary contractor engaged in accident-derived waste disposal should assign the radiation administrator to perform the following tasks in addition to those specified in (1) under the direction of the safety and health manager assigned by the primary contractor.

a The radiation administrator should prepare the place of contamination inspection and inspect contamination in an appropriate manner upon consulting with the primary contractor.

b The radiation administrator should guide or support the relevant subcontractors' radiation administrators to ensure that the relevant subcontractors takes the measures stated in 2 to 4 of Section 3 in an appropriate manner.

c The radiation administrator should implement any other tasks necessary for radiation control.

4. Safety and health management system by disposal operators

(1) The disposal operator should assign a health supervisor or safety and health promoter according to the site scale to manage the technical matters regarding operating actions for radiation dose measurements and their recording, contamination inspection, prevention of body surface/internal contamination, education for workers, and actions for health management.

It is recommended that a safety and health promoter be assigned even at the site where the number of workers is less than ten.

(2) The disposal operator should assign a radiation administrator regardless of the site scale to perform activities regarding radiation dose measurements and their recording, contamination inspection, and prevention of body surface/internal contamination.

Section 12 Exemptions for special decontamination areas

1. Exemptions in the case of constructing disposal sites in special decontamination areas

(1) Measures against spillage of radioactive materials outside the accident-derived waste handling facility

In the case of spillage of radioactive materials discharged by the accident outside of a disposal site established in a special decontamination area, where the surface contamination has already exceeded 4 Bq/cm^2 due to contamination by radioactive materials discharged by the accident, regardless of the provision in 4 of Section 4, it should be sufficient for the disposal operator to remove the contamination to the surface contamination density on average around the disposal site (background), upon taking actions to prevent spread of contamination and clearly indicating the contaminated area.

(2) Contamination inspection and acceptable contamination limit

With respect to contamination inspection and contamination limit in a disposal site established in a special decontamination area, the provisions in Articles 14 and 15 of the Ionizing Radiation Ordinance for Decontamination should be applied with modifications, regardless of 2 of Section 6. Also it should be sufficient to prepare for one contamination inspection place in or around the disposal site, and 40 Bq/cm^2 should be defined as the contamination limit.

(Note) The outside of a disposal site established in a special decontamination area has already been contaminated with radioactive materials discharged by the accident. Thus, the exemption was established from the standpoint that contamination has to be controlled in order not to spread further than before the disposal site is constructed.

(Note) The same reason applies to the contamination inspection and its place: the exemption was established from the standpoint that it is sufficient to conduct the inspection by following the cases when the activities such as soil decontamination are conducted, as specified in the Ionizing Radiation Ordinance for Decontamination.

2. Exemptions when handling removed soil at landfill facilities constructed in special decontamination areas

(1) Containers

When the disposal operator handles removed soil at a landfill facility constructed in a special decontamination area and if the case conforms to the following statements, it should be acceptable not to use containers, regardless of the regulations specified in 1 of Section 6.

a. Removed soil is unlikely to contaminate workers body surfaces because it is handled by using remotely operated machines.

b. Measures have been taken to control dust dispersion such as by maintaining removed soil in a wet state.
c. Measures have been taken to control dust dispersion such as by separating it away to the outer periphery of the landfill facility from work area.
d. Surface density at the border of the landfill facility is inspected once within every month, and measures have been taken to remove any contamination if the removed soil-derived contamination was observed.

(2) Accident-derived waste handling facilities

If the disposal operator handles non-sealed removed soil at a disposal site constructed in a special decontamination area and if the case conforms to the following statements, it should be acceptable to skip actions described in 2 (2) to 2 (4) of Section 5.

a. Removed soil will not contaminate the workers' body surface because it is handled by using remotely operated machines.
b. Measures have been taken to control dust dispersion such as by maintaining removed soil in a wet state.
c. Measures have been taken to control dust dispersion such as by separating work involving dust generation on the outer periphery of the landfill facility from the general work area.
d. Surface density at the border of the landfill facility is inspected once within every month, and measures have been taken to remove contamination if removed soil-derived contamination was observed.

(Note) Exemptions were established regarding measures to prevent spread of contamination when removed soil is handled outdoors in disposal sites, based on the fact that soil has been already contaminated with radioactive materials discharged by the accident, and the situation that soil contaminated with such radioactive materials continues to be transported into the disposal site from outside it.

(Note) It was decided that use of containers can be exempted if removed soil is handled by remotely operated machines, and actions are taken to control dust dispersion and spread-out because the provisions regarding containers aim to both prevent the bodies of workers handling removed soil from being contaminated and prevent spread of contamination. Furthermore, it was decided that an obligation regarding regular inspections on surface density is put in place in order to make sure that measures to prevent spread of contamination have been implemented in an appropriate manner, and that if any contamination is observed decontamination is required in order to reduce the contamination to the average surface contamination level around the disposal site. The Exemption was established for the accident-derived waste handling facilities as well based on the same concept.

(Note) When handling removed soil using remotely operated machines, workers are allowed to enter the facility for a short period of time in order to troubleshoot failed components, investigate the state, and perform maintenance and inspection on the equipment. However, such workers should be required to interrupt the handling operation in advance to control dust emission, and they shall wear appropriate protective equipment and clothing at the time of entry.

(Note) The "methods such as by handling removed soil using remotely operated machines" includes operation in specially customized transportation vehicles with high sealing ability. In this case, however, based on the objectives of 1 and 2 of Section 4, and 2 of Section 5, it is required that the effective doses from airborne radioactive materials inside of such vehicles and from external radiation do not exceed 1 mSv per week, that measures be taken to easily remove surface contamination, that surface contamination be inspected once or more every month, and that contamination be removed if it exceeds 40 Bq/cm^2.

IV. References

1. Facility requirements and radiation dose limit at disposal sites (material for the 4th meeting)
2. Basic concept regarding interim storage facilities required to manage environmental contamination due to radioactive materials discharged by the accident at TEPCO Fukushima Daiichi Nuclear Power Plant (material for the 1st meeting)
3. Overview of waste treatment and facility management (material for the 1st meeting)
4. Pre-treatment of waste during interim treatment (example) (material for the 2nd meeting)
5. Work flow for landfilling specified waste at final disposal sites (material for the 2nd meeting)
6. The criteria for selecting respiratory protective equipment used by workers engaged in decontamination waste disposal (material for the 2nd meeting)
7. The concept in the “Laws Concerning the Prevention from Radiation Hazards due to Radioisotopes and Others” and the “Nuclear Reactor Regulation Law” (material for the 3rd meeting)
8. Estimation of dust concentration generated during decontamination waste disposal and selection of respiratory protective equipment (material for the 4th meeting)

Attachment 1 Measurement method of radioactivity concentration of accident-derived waste

1. Objectives

The objectives of measuring radioactivity concentration of accident-derived waste are: to help the disposal operator determine whether the accident-derived waste exceeds the reference value (10,000 Bq/kg, 500,000 Bq/kg or 2,000,000 Bq/kg); and to decide necessary actions to prevent workers' exposure to radiation before assigning any activities for disposing of accident-derived waste.

2. Basic concept

(1) When accepting accident-derived waste at a disposal site, the disposal operator should obtain a written form from collecting/transporting operators giving the radioactivity concentration measurements of the said accident-derived waste that have already been measured.

(2) The disposal operator should measure the radioactivity concentration in each container when accepting the waste, with reference to the obtained radioactivity concentration measurements.

(3) It is recommended that radioactivity concentration be measured by commissioned experts.

(4) The disposal operator is not required to measure radioactivity concentration at the time of acceptance, provided that actions specified in the relevant laws and regulations have been taken under the assumption that the concentration of the accepted waste exceeds 10,000 Bq/kg, based on the known radioactivity concentration measurement results provided by collecting/transporting operators, and that the accident-derived waste will be handled as sealed in containers.

3. Sampling

(1) Principles for sampling

a. Take one sample per container.

b. It is acceptable to measure the whole container as a sample when the simplified measurement in 4 (2) below is selected.

4. Analysis methods

Either method below should be used for analysis.

(1) The total gamma ray measurement or gamma spectrum analysis specified in Paragraph 1-2 of Article 9 of the working environment measurement standards.

(2) Simplified measurement method

a. The radioactivity concentration should be calculated using the following method if the correlation between the radiation dose rate on the sample surface and the sum of the concentrations of cesium-134 and cesium-137 has been identified. (See Annex 1-1 for

details.)

(i) Place the sample in a container and measure the weight.

(ii) Measure the maximum radiation dose rate on the surface of the container.

(iii) Using the measured weight and radiation dose rate, calculate the sum of the concentrations of cesium-134 and cesium-137 of the sample in the container.

b. It is difficult to measure radioactivity concentration equal to 300,000 Bq/kg or above with the simplified method even when using the Round V-series container (plastic jar 128 mm diameter x 56 mm height) because the upper measurement limit of the typical NaI scintillation survey meter is as low as 30 μSv/h. Therefore, when the needle on the indicator of the survey meter goes past 30 μSv/h, the relevant regulations should be applied under the assumption that the concentration of the measurement target exceeds 500,000 Bq/kg, or analysis should be carried out using the method of (1) above.

Annex 1-1. Simplified measurement procedures of radioactivity concentration

1. Method for determining whether the radioactivity concentration of round V-series containers (plastic jar 128 mm diameter x 56 mm height, hereinafter referred to as the "V5 container") is below 10,000 Bq/kg or 500,000 Bq/kg

The following is the criteria for determining whether the radioactivity concentration of the V5 container containing accident-derived waste is below 10,000 Bq/kg or 500,000 Bq/kg

(1) Measure the radiation dose rate on the surfaces of the V5 container containing accident-derived waste, and define the largest value as *A* (μSv/h).

(2) Determine the radioactivity *B* (Bq) of the V5 container containing accident-derived waste by plugging in factor *X* depending on the measurement date and the measured radiation dose rate *A* (μSv/h) in the following formula. Table 1 lists the factor *X* values for each measurement date.

A x Factor *X* = *B*

(3) Measure weight of the V5 container containing accident-derived waste. This is set as *C* (kg).

(4) To determine the radioactivity concentration *D* (Bq/kg) of the V5 container containing accident-derived waste, substitute the radioactivity *B* (Bq) of the V5 container containing accident-derived waste and the weight *C* (kg) in the following formula.

$B \div C = D$

Thus, it can be determined whether the radioactivity concentration *D* of the V5 container containing accident-derived waste is below 10,000 Bq/kg or 500,000 Bq/kg.

2. Method for determining whether the radioactivity concentration of sandbags is below 10,000 Bq/kg

The following is the criteria for determining whether the radioactivity concentration of sandbags containing accident-derived waste is below 10,000 Bq/kg.

(1) Measure the radiation dose rate on the surfaces of sandbag containing accident-derived waste, and define the largest value as *A* (μSv/h).

(2) Determine the radioactivity *B* (Bq) of the sandbag containing accident-derived waste by substituting the factor *X* value depending on the measurement date and the measured radiation dose rate *A* (μSv/h) in the following formula. Table 1 lists the factor *X* values for each measurement date.

A x Factor *X* = *B*

(3) Measure the weight of the sandbag containing accident-derived waste. This is set as *C* (kg).

(4) To determine the radioactivity concentration *D* (Bq/kg) of the sandbag containing accident-derived waste, substitute the radioactivity *B* (Bq) of the sandbag containing

accident-derived waste and the weight *C* (kg) in the following formula.

$B \div C = D$

Thus, it can be determined whether the radioactivity concentration *D* of the sandbag containing accident-derived waste is below 10,000 Bq/kg.

Table 1 Values of the factor *X* listed by the measurement date and container type

Measurement date	Factor *X*	
	V5 Container	Sandbag
Until January 2013	3.3E+04	7.4E+05
Until April 2013	3.3E+04	7.5E+05
Until July 2013	3.4E+04	7.6E+05
Until October 2013	3.4E+04	7.8E+05
Until January 2014	3.5E+04	7.9E+05
Until April 2014	3.6E+04	8.1E+05
Until July 2014	3.6E+04	8.2E+05
Until October 2014	3.7E+04	8.3E+05
Until January 2015	3.8E+04	8.5E+05

(Note) Further study will be conducted to determine if a factor can be provided for the case of a flexible container.

Attachment 2 Method to determine whether an activity is the work under high dust concentration environment

1. Objectives

The criterion to determine whether an activity is the work under high dust concentration environment should be used for the operator to determine whether dust concentration exceeded the lower limit of high-level dust concentration of 10 mg/m^3 during the activity, and to determine the measurement methods necessary to control committed dose.

2. Basic concept

(1) The simplified measurement instead of the accurate one can be accepted so long as the operator can determine whether the dust concentration exceeds the lower limit of the high-level dust concentration of 10 mg/m^3.

(2) It is recommended that the measurement be performed by commissioned experts.

3. Measurement method

(1) In order to determine whether the activity falls under the work under high dust concentration environment, use a personal sampler during the activity, or follow the relative concentration indication method basically using a digital dust meter to measure dust concentration near workers during the activity in which dust is generated.

(2) The measurement method should be as follows.

a. During the activity in which dust is generated, measure the relative concentration (cpm) for 2 - 3 minutes using a digital dust meter (e.g., LD-5) in the proximity, to the extent that it does not disturb the workers engaged in the activity.

b. It is desirable to collect the relative concentration measurements stated in a from all of the workers engaged in the activity. However, when several workers do similar tasks within a distance of several meters, it is sufficient to measure one worker of the group.

c. Set a digital dust meter and inhalable dust concentration measurement instrument in parallel in the proximity (downwind), to the extent that it does not disturb the activity, of the worker with the highest relative concentration (cpm) from the simple measurement in a, and measure the concentration continuously for 10 minutes or more to calculate a mass-concentration conversion factor.

(i) The target for dust concentration measurement should be airborne inhalable dust (respiratory dust, particle diameter 100μm, 50% cut) that is inhaled through the nose or mouth.

(ii) Use an open-face type of sampler to measure inhalable dust at the face velocity of 18

(cm/s) on a sampling filter paper.

(iii) Follow Article 2 of the working environment measurement standards except for the particle diameters and measurement positions of the dust particle separator.

(3) Calculate dust concentrations (mg/m^3) from the relative concentration measurements in (2) a, using a mass-concentration conversion factor determined by result c. If the highest value of the measurements exceeds 10 mg/m^3, the concentrations of all the other workers involved in the same task should be considered as exceeding 10 mg/m^3.

(Note) Further study will be conducted to determine if the standard mass-concentration conversion factor can be provided.

Attachment 3 Special education for workers

Workers engaged in activities for accident-derived waste disposal should be educated through lectures and practical training.

1. Lectures should provide the education described in the middle column of the following table according to each subject listed in the left column. Hours for each subject should be more than that in the right column.

Subject	Coverage	Minimum duration
Influence of ionizing radiation on living organisms and exposure dose control method	(1) Types and properties of ionizing radiations (2) The influence of ionizing radiation on cells, tissues, organs and entire bodies of living organisms (3) Radiation exposure dose limit and methods for measuring radiation exposure dose (4) Methods for confirming and recording the radiation exposure dose measurement results	1 hour
Knowledge on activities involved in accident-derived waste disposal	(1) Instructions and procedures for the activities involved in accident-derived waste disposal (2) Method for measuring radiation (3) Monitoring method of dose equivalent rate from external radiation (4) Instructions for actions to prevent contamination (5) Inspection and removal of contamination on body surfaces (6) Functions and use of protective equipment (7) Emergency actions in case of an abnormal event	1 hour
Knowledge about structure and handling of the machines used for the activities of accident-derived waste disposal	The structure and handling of the machines used for the activities of accident-derived waste disposal	1 hour
Relevant laws and regulations	Relevant provisions of the Industrial Safety and Health, Enforcement Order of the Industrial Safety and Health Act, Ordinance on Industrial Safety and Health, and Ionizing Radiation Ordinance.	1 hour

2. Training should provide the education described in the middle column of the following table according to each subject listed in the left column.. Hours for each subject should be more than that in the right column.

How to dispose of accident-derived waste and handling of the equipment used for the work	(1) Work related to the activities of accident-derived waste disposal (2) Handling of radiation measurement instruments (3) Monitoring dose equivalent rate from external radiation (4) Actions to prevent contamination (5) Inspection of contamination on the body surface and removal of the contamination (6) Handling and use of protective equipment (7) Handling of the equipment used for the activities of accident-derived waste disposal	1.5 hours