

## **Guidelines on Prevention of Radiation Hazards for Workers Engaged in Decontamination Works**

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(Amendment: Labour Standards Bureau Notification No. 0615-6, 15 June 2012)

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### Section 1 Objectives

These guidelines are established for the purpose of preventing radiation-related health hazards to workers engaged in decontamination works of objects contaminated with radioactive materials discharged by the accident of the Fukushima Daiichi Nuclear Power Plant of Tokyo Electric Power Company (TEPCO) associated with the Great East Japan Earthquake on 11 March 2011, in conjunction with the enforcement of the "Ordinance on Prevention of Ionizing Radiation Hazards at Works to Decontaminate Soil and Wastes Contaminated by Radioactive Materials Resulting from the Great East Japan Earthquake and Related Works" (Ordinance of the Ministry of Health, Labour and Welfare No. 152 of 2011; hereinafter referred to as the "Ionizing Radiation Ordinance for Decontamination")

Together with the Ionizing Radiation Ordinance for Decontamination, these guidelines aim at a proper effort to help further promote the measures for the prevention of radiation hazards during the decontamination works and a collective provision of the essence of the actions that employers should take including the provisions specified in the Industrial Safety and Health Act (Act No. 57, 1972) and other relevant laws and regulations, in addition to the provisions specified in the Ionizing Radiation Ordinance for Decontamination.

The intention of these guidelines is to protect workers from radiation hazards. However, it also has the purpose of being used for individual proprietors, self-employed workers and volunteers.

The employers should make efforts to implement the matters described in these guidelines appropriately and take measures to prevent the radiation hazards corresponding to actual situations in their workplaces.

### Section 2 Scope

1 These guidelines shall be applied to employers engaged in the operation of decontamination

related works (hereinafter referred to as the “employers of decontamination works, etc.”) in the special decontamination areas specified in Article 25, paragraph (1) of the "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 " (Act No. 110 of 2011) or in the intensive contamination survey areas specified in Article 32, paragraph (1) of the same Act (hereinafter referred to as the "special decontamination areas, etc."; refer to Attachment 1), with due attention being paid to the following:

- (1) “Decontamination works” refers to the work to perform decontamination of soil, etc., handling of designated contaminated soil and wastes. and collecting waste, etc.

However in the case of works, other than the decontamination works in the special decontamination areas, etc. where the average ambient dose rate exceeds  $2.5\mu\text{Sv/h}$ , (hereinafter referred to as the “works under a designated dose rate”) being carried out, relevant provisions in the Ionizing Radiation Ordinance for Decontamination and “Guidelines on Prevention of Radiation Hazards for Workers Engaged in Works under a Designated Dose Rate” (Labour Standards Bureau Notification No. 0615-6 of 15 June 2012) shall be applied.

- (2) The “work for decontamination, etc.” refers to the work to remove soil, grass and trees, soil generated in association with the decontamination of structures, etc., fallen leaves and branches and sludge, etc. deposited in dikes, etc. (hereinafter referred to as “contaminated soil, etc.”) contaminated with the radioactive materials released from the accident of the nuclear power plant (hereinafter referred to as the “radioactive materials discharged by the accident” as defined under provisions of Article 2, paragraph 2 in the Ordinance on Prevention of Ionizing Radiation Hazards (Ministry of Labour Ordinance No. 41 of 1972; hereinafter referred to as the “Ionizing Radiation Ordinance”) and to prevent the contamination from spreading, and to take other measures.

- (3) The “works for handling of designated contaminated soil and wastes” refer to the works to handle contaminated soil, etc. whose radioactivity concentration of Cs-134 and Cs-137, among radioactive materials discharged by the accident, exceed  $10,000\text{Bq/kg}$  (hereinafter referred to as the “designated contaminated soil and wastes”), but exclude the works for decontaminating soil, etc. and collecting wastes, etc.

It should be noted that the “works for handling of designated contaminated soil and wastes” include those works in the special decontamination areas, etc., of construction works for restoring local infrastructures (construction preparation, excavation and transportation, banking and compaction, leveling and shaping of land and slope protection), and relevant works such as foundation work, temporary construction, road construction, water supply and sewage construction, service water and drainage construction, and earth works associated with farmland maintenance works, works involving soil such as turning and plowing the soil, weeding, digging the soil, etc. for commercial farming and forestry, etc., and works handling soil, etc. associated with fertilization (mixing into the soil), rice planting, seeding, raising and harvesting, etc. of root crops. It should be noted, however,

that such works mentioned above that could be finished in a short time as temporary works should be excluded from the “works for handling of designated contaminated soil and wastes”.

- (4) The “work for collecting waste, etc.” refers to the works to collect, transport or store removed soil or waste contaminated with the radioactive materials discharged by the accident (limited to waste which contains radioactivity concentration of Cs-134 and Cs-137, among radioactive materials discharged by the accident, exceeding 10,000Bq/kg; hereinafter referred to as “contaminated waste”). It should be noted that, for the disposal works of removed soil or contaminated waste such as works at water/sewage facilities, incineration facilities, intermediate treatment facilities and landfill facilities, etc. in the special decontamination areas, etc., significant radiation exposure from the administrated radiation source such as sludge from sewage or incineration ash, etc. is expected, and therefore the Ionizing Radiation Ordinance should be applied to those works instead of the Ionizing Radiation Ordinance for Decontamination or these guidelines.
- (5) The “works for handling designated contaminated soil and waste” refers to the works to handle contaminated soil, etc. whose radioactivity concentration of Cs-134 and Cs-137, among radioactive materials discharged by the accident, exceeds 10,000Bq/kg (hereinafter referred to as the “designated contaminated soil and wastes”), but excludes the works for decontaminating soil, etc. and collecting waste, etc. In addition, the “works for handling designated contaminated soil and wastes” includes construction works for restoring local infrastructures (construction preparation, excavation and transportation, banking and compaction, leveling and shaping of land and slope protection), and relevant works such as foundation work, temporary construction, road construction, water supply and sewage construction, service water and drainage construction, and earth work associated with farmland maintenance work, works involving soil such as turning and plowing the soil, weeding, digging the soil, etc. for commercial farming and forestry, etc., and works handling soil, etc. associated with fertilization (mixing into the soil), rice planting, seedling, raising and harvesting, etc. of root crops in the special decontamination areas, etc. It should be noted, however, that such works mentioned above that could be finished in a short time as temporary work should be excluded from the “works for handling of designated contaminated soil and wastes.”
- (6) For decontamination work conducted under the Ionizing Radiation Ordinance in the radiation control area (solely limited to the nuclear reactor facilities and facilities belonging to the steam turbine or those surrounding areas where dose rate might exceed 0.1mSv/h (hereinafter referred to as the “designated facility, etc.”) of TEPCO Fukushima Daiichi Nuclear Power Plant) under the provisions of Article 3, Paragraph 1 in the Ionizing Radiation Ordinance at the time of enforcement of the Ionizing Radiation Ordinance for Decontamination, the Ionizing Radiation Ordinance should be applied in succession instead of the Ionizing Radiation Ordinance for Decontamination or these guidelines. The work handling unsealed radioactive materials in the designated facilities is subject to the

contamination screening described in Section 5-3 in these guidelines.

(7) Since decontamination works fall under Article 8, item 35 in the Ordinance on Child Labour Standard (Ministry of Labour Ordinance No. 13 of 1954), employers should not engage persons who are under 18 years old in such decontamination works.

2. Employers other than “employers of decontamination related workers, etc.” who carry out decontamination works, etc. in their own site or facilities, etc. should implement applicable matters from Section 3 “Targets and Methods for Radiation Exposure Dose Control”, Section 5 “Measures for Preventions of Contamination Spreading and Internal Exposure” and Section 6 “Education for Workers”, as needed. It is also recommended that self-employed workers, residents and volunteers who perform decontamination works follow the said matters.

## Section 3 Targets and Methods for Radiation Exposure Dose Control

### 1 General Principles

(1) Employers of decontamination works, etc. should make efforts to minimize exposure to ionizing radiation for the workers to the fullest extent possible.

(2) When employers of decontamination works, etc. implement works for handling designated contaminated soils and wastes, they should prioritize minimizing the radiation exposure received by the workers engaged in handling designated contaminated soil and wastes (hereinafter referred to as the “workers engaged in handling designated contaminated soil and wastes”), and they also should make efforts to take measures such as decontamination of workplaces in advance.

(a) Principle (1) above states that employers should keep radiation exposure of their workers as low as reasonably achievable based on the principles of optimization by the International Commission on Radiological Protection (ICRP) when they perform their work.

(b) Principle (2) above states that, when work is expected to have a certain level of radiation exposure, it is necessary to prioritize in minimizing such a dose received by the workers engaged in handling designated contaminated soil and wastes, and make efforts to implement decontamination measures, prior to starting the work, based on the ICRP principle of justification (hereinafter referred to as “the principle of justification”). This is because the public interest and the necessity of the work should outweigh its demerits.

(c) However, among works for handling designated contaminated soil and wastes, it may not be possible to implement measures of decontamination, etc. in advance for the minimum requirements such as restoration of roads and the water supply, etc., in light of the high public interest and necessity. In addition, works such as soil covering, paving roads, turning and plowing of farmland, etc. are expected to have equal to or greater effects than the measures of decontamination, etc. for reducing radiation dose, and therefore such works may be regarded as being implemented concurrently with

decontamination.

- (d) In light of the principle of justification, farming employers, etc. are required to decontaminate working areas in advance to reduce radiation exposure to the lowest level as possible, and in principle, assign the workers in the area where the average ambient dose rate is less than  $2.5\mu\text{Sv/h}$ , so that there is no need to control exposure dose, since the workers in these types of businesses tend to have higher exposure doses associated with long hours of work and the work is considered not necessarily urgently needed.

## 2 Measurement of radiation exposure doses

- (1) Employers of decontamination works, etc. should conduct effective exposure dose measuring during decontamination works in each case described in the following (a) and (b) by the pre-defined methods of measuring the equivalent exposure doses for workers (including fixed-term contract workers and temporary workers, hereinafter referred to as “workers engaged in decontamination works, etc.”) who are engaged in decontamination related works in the special decontamination areas, etc. (The works among decontamination works which temporary workers are not allowed to engage in are listed in Attachment 2.)
- (a) In the case where the employer has workers engage in any works for decontamination and related works in a workplace for which the average ambient dose rate exceeds  $2.5\mu\text{Sv/h}$  (equivalent to  $5\text{mSv/year}$  based on 40 h/week and 52 weeks/year), such employers shall conduct internal exposure dose measurements, which shall be appropriate according to the specifics of the works and concentration of radioactive materials contained in contaminated soil, etc. to be handled, in addition to external exposure dose measurements by personal dosimeters. Among the works related to designated contaminated soil and wastes, the restoration works, etc. of local infrastructures, for which workplaces cannot be confined by the nature of the works, shall require the measurements of both external and internal exposure doses, only when workers are expected to perform such works in a place of which average ambient dose rate exceeds  $2.5\mu\text{Sv/h}$ .
- (b) In the case where workers are engaged in any works for decontamination and related works (except any works that involve handling of designated contaminated soil and wastes) in a workplace for which the average ambient dose rate is  $2.5\mu\text{Sv/h}$  or less, either of the following may also be deemed as the external exposure dose, as well as the external exposure dose measured by personal dosimeters:
- The “average ambient dose rate” multiplied by “daily working hours of each worker engaged in decontamination related works”, or
  - The measurement result on a typical individual assumed to represent the average external exposure dose from decontamination related works.
- (2) In the case that employers other than “those of decontamination works, etc.” who conduct works of decontamination, etc. of their own premises or facilities, etc., they should make sure that effective dose due to the work should not exceed  $1\text{mSv/y}$ , by assigning their workers to

conduct decontamination, etc. in workplaces with the average ambient dose rate of 2.5 $\mu$ Sv/h or less as well as frequency of work being within dozens of times (days) per year. Self-employed workers, residents and volunteers who conduct works of decontamination, etc., should also do likewise, by taking note of the following matters.

- (a) The residents and self-employed workers are expected to conduct works of decontamination, etc. as a community unit when they need to decontaminate soil of their own residences, offices, farmlands and so forth in the area where the average ambient dose rate might exceed 2.5 $\mu$ Sv/h. In such cases, frequency of the works should be less than dozens of times (days) per year, to prevent them from receiving effective doses higher than 1mSv/y through the works.
  - (b) In the case of recruiting volunteers in an area not classified as the special decontamination areas, the volunteer organizers should note that the exposure dose limit of the public to radiation sources is specified as 1mSv/y as recommended by the ICRP under the planned exposure situation.
- (3) Since it is difficult for self-employed and individual proprietors to manage their exposure doses, etc. by themselves, it is desirable not to conduct works for handling designated contaminated soil and wastes by taking appropriate measures in advance such as decontamination of workplaces.
- (a) In the case that individual proprietors and self-employed workers need to do works for handling designated contaminated soil and wastes, they should be regarded as employers of workers for handling designated contaminated soil and wastes, thus these guidelines should be applied to them.
  - (b) For volunteers, it is necessary to make sure that the average ambient dose rate at the workplaces does not exceed 2.5 $\mu$ Sv/h (equivalent to 5mSv/y calculated on the basis of 40 hours/week and 52 weeks/y) and frequency of work should be less than dozens of times (days) per year so that they do not get an effective exposure dose greater than 1mSv/y.
- (4) For the measuring of internal exposure doses stated in (1)-(a) above, it should be carried out by the methods given in the table below according to the concentration of radioactive materials discharged by the accident in contaminated soil, etc. to handle and to dust concentration during the decontamination related work. In the case that no highly radioactive contaminated soil and wastes is handled and dust concentration is not high, it is enough to conduct screening tests only when incidentally exposed to a high concentration of dust.

	Concentration of radioactive materials in contaminated soil, etc. exceeding 500,000Bq/kg (highly radioactive contaminated soil and wastes)	Other than highly radioactive contaminated soil and wastes
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Work under dust concentration greater than 10mg/m <sup>3</sup> (work under high dust concentration)	Measurement of internal exposure dose once every three months	Screening test
Work other than under high dust concentration	Screening test	Screening test (only when incidentally exposed to high concentration of dust)

(5) To determine whether the work falls under high dust concentration or not, the following matters should be referred to:

- (a) Such works like stripping of soil, etc., surface grinding or chipping of asphalt or concrete, weeding, collection and packing of removed soil, etc., dismantling of buildings or structures, etc. in a dry condition are considered as works under dust concentration greater than 10mg/m<sup>3</sup>, and measures should be taken as defined in Paragraph 2, Item (4) above and Section 5, Paragraph 5.
- (b) When dust concentration is measured during the work regardless of the definition in (a) above, it should be judged whether or not the work falls under high dust concentration according to the measurement results. Refer to Attachment 3 for judgment by the measurement results.

(6) The screening test method of internal exposure shall follow the method shown in Attachment 4.

The calculation method of internal exposure dose shall be in accordance with the stipulations of Article 6 of the “Methods, standards and classification defined by the Minister of Health, Labour and Welfare as specified pursuant to Article 2 , Paragraph 7, etc. of the Ordinance on Prevention of Ionizing Radiation Hazards at Works to Decontaminate Soil and Wastes Contaminated by Radioactive Materials Resulting from the Great East Japan Earthquake and Related Works” (Ministry of Health, Labour and Welfare Notification No. 468 of 2011).

### 3 Exposure dose limits

(1) Employers of decontamination works, etc. should measure the effective dose by the methods defined in 2-(1) (a) and (1) (b) above respectively, and ensure that the individual total effective dose which a worker may receive during engaging in the decontamination work, etc. does not exceed the following limits:

- (a) For male workers and female workers who will not become pregnant: Effective doses as 100mSv per five years and 50mSv per one year.
- (b) For female workers (except those who will not become pregnant, or those who fall into category (c) below): Effective doses as 5mSv per three months.
- (c) For pregnant female workers: Effective doses by internal exposure as 1mSv and equivalent doses as 2mSv on the abdominal surface for the period from when confirmed as pregnant to the delivery (hereinafter referred to as “during pregnancy”).

- (2) When employers of decontamination works, etc. assign their workers to decontamination works who have engaged in radiation works in the radiation control area defined in Article 3 of the Ionizing Radiation Ordinance or who engaged in the works under a designated dose rate, it is necessary to ensure that the sum of effective dose for individual workers during radiation works or works under a designated dose rate and the effective dose measured according to 2-(1) above should not exceed the limits specified in (1) above.
- (3) To properly control the radiation exposure doses of workers engaged in decontamination and related works in multiple different workplaces, the period of "five years" prescribed in (1) (a) above shall be quinquennial periods of which the first period starts on 1 January 2012 uniformly for all workplaces where decontamination works, etc. are performed. The same shall apply to employers that newly start decontamination and related works as their business in the middle of any of such quinquennial periods. In such cases, the value of 20mSv multiplied by the number of years from the commencement date of such decontamination works till the end of the corresponding quinquennial period shall be deemed as the exposure dose limit for the period ending at the end of such a quinquennial period and shall be used for application of relevant regulations.
- (4) The periods of "one year" prescribed in (1) (a) above shall be yearly periods of which the first period starts on the first date of "five years". The radiation dose received during the period from 11 March 2011 till 31 December 2011 shall be deemed as the dose received on 1 January 2012 and shall be included therein.
- (5) For the works for handling of designated contaminated soil and wastes, the exposure doses received during the period from 1 January 2012 to 30 June 2012, if known, should be added on the dose on or after 1 July 2012 for the exposure dose control purpose.
- (6) If an employer of decontamination works, etc. newly employs workers for engaging in decontamination works in the midst of the period of "one year" or "five years", they should check the exposure dose history of each worker, at a special medical examination at the time of employment, received from the corresponding first date of the "one year" or the "five years" till the date prior to engaging in the decontamination works by using his/her record issued by his/her previous employer (if no records are available, records should be reissued by the previous duty station).
- (7) The starting dates described in (3) and (4) should be known to the workers for decontamination works.
- (8) The starting dates should be made known to the workers for decontamination and related works .

#### 4 Records of dose measurements, etc.

- (1) Employers of decontamination works, etc. should determine the exposure dose of workers for decontamination works as described below based on measurements made or by calculations according to the description in 2 above, record the results and keep those records for 30 years. However, this provision shall not be applicable to the records that are transferred to the organization designated by the Minister of Health, Labour and Welfare (Radiation Effects



Association, a public interest incorporated foundation) after such records have been kept for five years or after the workers for decontamination works recorded therein have left the job. In these cases, Form 1 (as an example) may be filled in for recording.

Among the workers for decontamination works, those who were radiation workers specified in Article 4, Paragraph 1 of the Ionizing Radiation Ordinance or those who engaged in works under a designated dose rate, the exposure doses received during the period of engaging in radiation work or the period of engaging in works under a designated dose rate should be added onto those received during engaging in decontamination works and the results should be recorded and kept accordingly.

- (a) For male workers and female workers who will not become pregnant, the effective dose should be summed up for every three months, for every one year and for every five years. (For those whose effective dose has never exceeded 20mSv/y for five years, the effective dose to be summed up for every three months and for every one year.)
  - (b) For female workers who may become pregnant, the effective dose should be summed up for every month, for every three months and for one year. (For those who expect not to receive effective dose higher than 1.7mSv/month, the effective dose should be summed up for every three months and for one year.)
  - (c) For pregnant female workers, the effective dose of internal exposure and equivalent dose received on their abdominal surface should be summed up for one month and during pregnancy.
- (2) Employers of decontamination works, etc. should notify the workers for decontamination works of the record of the exposure dose defined (1) above without delay.
  - (3) When any employer of decontamination works, etc. intends to discontinue its operation, the employer shall transfer the records referred to in (1) above to the organization designated by the Minister of Health, Labour and Welfare (Radiation Effects Association, a public interest incorporated foundation).
  - (4) Employers of decontamination works, etc. should issue copies of the records defined in (1) above to the worker who is going to leave the job or to all of the workers if they terminate their business.
  - (5) When employers of decontamination works, etc. employ fixed-term contract workers or temporary workers, they should take note of the following matters in order to control their exposure doses appropriately.
    - (a) When employing fixed-term contract workers or temporary workers for a pre-defined period of less than three months, the exposure dose should be determined and recorded every month.
    - (b) At the end of the contract period, the employer should sum up the effective dose which the contractor received during the contract period and determine the exposure dose from the results, record them and issue a copy of the records to that person.

#### Section 4 Measures to Reduce Radiation Exposure

## 1 Prior radiological evaluation

- (1) When employers of decontamination works, etc. carry out decontamination works, they should make surveys of workplaces in advance with respect to the items described below and record the results.

When the works for handling designated contaminated soil and wastes are conducted continuously in one area, the survey at the said area is to be conducted with respect to the items described below once every two weeks during the period of the work and the results are to be recorded. However, if the results show the average ambient dose rate and the concentration of radioactive material are consistently lower than  $2.5\mu\text{Sv/h}$  and  $10,000\text{Bq/kg}$ , respectively, there is no need for further routine survey.

- (a) Conditions of the area for decontamination related works
  - (b) Average ambient dose rate ( $\mu\text{Sv/h}$ ) for the area for decontamination related works
  - (c) Radioactivity concentration ( $\text{Bq/kg}$ ) of Cs-134 and Cs-137 in contaminated soil and wastes, removed soil or contaminated waste.
- (2) Employers of decontamination works, etc. should clearly disclose in advance the date of the survey completion in (1) above, methods of the survey and the summary of results in a written form, etc. to the workers who will be engaged in the decontamination works.
  - (3) When measuring average ambient dose rates, the following matters should be noted:
    - (a) Average ambient dose rates should be measured and evaluated in accordance with Attachment 5.
    - (b) The purpose of the prior radiological evaluation for the average ambient dose rate regarding the works for handling of designated contaminated soil and wastes is to determine if the average ambient dose rate at the workplace exceeds  $2.5\mu\text{Sv/h}$ , and accordingly to judge whether or not the exposure dose control is required. Therefore, if the employer judges that the average ambient dose rate at the workplace clearly exceeds  $2.5\mu\text{Sv/h}$  based on the results of the air-borne monitoring survey, etc. published by the Nuclear Regulation Authority, the results of the air-borne monitoring survey, etc. for the specific workplace concerned may be used instead of actual measurements of average ambient dose rates in those individual workplaces.
  - (4) When measuring concentration of radioactive materials, the following matters should be noted:
    - (a) Concentration of radioactive materials discharged by the accident in contaminated soil and wastes, removed soil or contaminated waste should be measured in accordance with the procedures shown in Attachment 6.
    - (b) Measurement of radioactivity of soil in farmlands, fallen leaf layers and soil in forests which are deemed to be an objective of the works for handling of designated contaminated soil and wastes in areas where the average ambient dose rate is  $2.5\mu\text{Sv/h}$  or less, may be substituted by estimation of radioactivity of contaminated soil and wastes from the average ambient dose rate shown in Attachments 6-2 and 6-3. If the estimates are less than  $10,000\text{Bq/kg}$ , the works there may be regarded as those that do not fall under the

works for handling designated contaminated soil and wastes.

However, when handling only soil near the surface of unplowed farmlands, or handling the fallen leaf layer or soil near the surface in forests, it is necessary to use a simple measurement method to determine concentration of radioactive materials in accordance with the procedures shown in Attachment 6-1 in order to determine whether or not the works fall under the works for handling designated contaminated soils and wastes.

- (c) The works in living zones (around buildings, structures and roads, etc.) may be regarded as not falling under the works for handling designated contaminated soil and wastes, regardless of the concentration of radioactive material in the soil near the surface, if the simple measurement by the procedures shown in Attachment 6-1 shows the concentration of radioactive material in the soil to be handled down to the digging depth is less than 10,000Bq/kg.

However, in case the work handles soil near the surface only without digging, it is necessary to determine, based on the measurement of the radioactivity concentration of soil near the surface, whether or not the work falls under the works for handling designated contaminated soil and wastes.

- (d) The purpose of prior radiological evaluation for the concentration measurement of radioactive materials in contaminated soil and wastes regarding the works for handling of designated contaminated soil and wastes is to determine whether the concentration of radioactive materials in the contaminated soil and wastes to be handled exceeds 10,000Bq/kg or 500,000Bq/kg. Therefore, if the employer of decontamination works, etc. judges that the concentration of radioactive materials in the contaminated soil and wastes to be handled clearly exceeds 10,000Bq/kg based on the results of the air-borne monitoring survey, etc. published by the Nuclear Regulation Authority, the results of the air-borne monitoring survey, etc. may be used instead of actual measurement of radioactivity concentration of the contaminated soil and wastes at the workplace. Furthermore, the measurement of concentration of radioactive materials is not required if that of the contaminated soil and wastes to be handled is clearly known as less than 10,000Bq/kg and therefore not subject to the works for handling designated contaminated soil and wastes, based on the lookup table in Attachment 6-2 or 6-3 and other information as well as considering the digging depth of soil and average ambient dose rate at the workplace

## 2 Formulation of the working plan and works based on the plan

- (1) When carrying out decontamination works, the employers of decontamination works, etc. should formulate a work plan based on the information from the preparatory survey, and the works should be conducted based on the plan (when handling designated contaminated soil and wastes, the works are limited to those in the workplaces where the average ambient dose rate exceeds 2.5 $\mu$ Sv/h).
- (2) The following items should be defined in the work plan.
  - (a) Workplaces of decontamination related works

- (b) Methods of decontamination related works
  - (c) Monitoring methods of exposure dose of workers for decontamination works
  - (d) Measures for reducing radiation exposure of workers for decontamination works
  - (e) Types and performance of machines, instruments and other equipment (hereafter referred to as “machinery”) to be used for the decontamination related works
  - (f) Emergency measures when work-related accidents occur
- (3) Employers of decontamination works, etc. should inform relevant workers of the details of the plan when the work plan has been established.
- (4) Employers of decontamination works, etc. should take note of the following matters when establishing the work plan.
- (a) The workplace should include the description of:
    - 1) Resting areas where eating, drinking or smoking is allowed.
    - 2) Contamination screening areas for a person leaving the area and for objects to take out.
  - (b) Methods of work should include the description of:-
    - Organization of workers, instructions to handle machinery, work procedures, working environment, etc.
  - (c) Measures for reducing radiation exposure should include the description of:
    - 1) Methods for measuring average ambient dose rate.
    - 2) Methods for reducing radiation exposure such as reduction of working hours, etc.
    - 3) Setting target values for exposure dose control based on the estimates of the exposure dose.
- (5) Principles for establishing resting areas where eating, drinking or smoking is allowed
- (a) The areas for eating and drinking should be basically isolated from the open air such as inside of vehicles, etc. If it is difficult to find such a place, eating and drinking should be allowed in the area where the following requirements are met. Smoking should also be allowed outside where the following requirements are met:
    - 1) Soil of high radioactivity does not exist in the vicinity.
    - 2) All workers should take a break simultaneously to prevent the inhalation of dust, and wait for about 20 min after interruption of the work, before eating, drinking, or smoking.
    - 3) Workers should stay on the windward side of the workplace. If that is not possible, at least workers should not stay in the downwind direction of the workplace.
  - (b) All workers should remove contaminated gear such as gloves, dust masks, etc. before eating, drinking or smoking, and decontaminate their hands by washing, etc. Workers should check for their own contamination before eating and drinking when they have handled highly radioactive contaminated soil and wastes.
  - (c) Used dust masks should be stored properly so that radioactive particles do not migrate to the inner side of the masks or they should be discarded (in the case of a screening test, the surface density of radioactive materials discharged by the accident on the surface of the mask should be measured before discarding it).
  - (d) Drinking of water is allowed only in an unavoidable case to prevent heat stroke, etc. It is

necessary to move to the windward side of the workplace and to take preventive measures for contamination before drinking by taking off gloves, etc.

(6) Principles for setting contamination screening areas

- (a) Employers of decontamination works, etc. should set a contamination screening area in the workplace or nearby for decontamination. The location of the contamination screening area should be on the boundary of the workplace, where they are responsible for decontamination. However, in case it is difficult to choose such a place for geographical or other reasons, it should be near the boundary.
- (b) Regardless of the above, it is allowed to place, at a certain location, a unified contamination screening area for multiple workplaces, if one employer of decontamination works, etc. undertakes decontamination works in several workplaces, and takes measures to prevent contamination by potentially contaminated workers or goods from spreading during moving from workplaces to the contamination screening area such as moving using air-tight vehicles, etc. This applies to the case that several employers of decontamination works, etc. set and use a unified contamination screening area collectively, or that the contamination screening area is set by the contractee.
- (c) The contamination screening area should be equipped with radiation measurement equipment, facilities for decontamination such as cleaning and washing, installation of temporary storage for contaminated soil and wastes, or removed soil or contaminated waste. The screening area can be outside as long as preventive measures are taken for contamination spreading, for example, covering the spot with a tent, etc.

3 Operation leaders

- (1) When carrying out decontamination works, employers of decontamination works, etc. should appoint an operation leader among workers who is recognized to be competent to direct the work, and delegate him/her to direct the work according to the work plan (when handling designated contaminated soil and wastes, the works are limited to those in the workplaces where the average ambient dose rate exceeds  $2.5\mu\text{Sv/h}$ ). The operation leader should conduct the following matters, too.
  - (a) To determine the work procedures appropriate for the work plan and distribute decontamination workers accordingly.
  - (b) To arrange a meeting on the work procedures with workers for decontamination works prior to undertaking the works.
  - (c) To check the machinery and equipment and remove defective pieces before starting the works.
  - (d) To supervise how radiation detectors and protective equipment are used.
  - (e) Prevent the unauthorized people from entering the workplace.
- (2) The work procedure should include the description of:
  - (a) The method of each task in the work procedure.
  - (b) The workplace, waiting area and resting area.
  - (c) The working hour control method.

#### 4 Submission of work notice

- (1) The employer of decontamination works, etc. who has received an order directly from a contractee (hereinafter referred to as "the primary contractor") should, when starting operation of works for decontamination, etc. or handling of designated contaminated soil and wastes at the workplace where the average ambient dose rate exceeds  $2.5\mu\text{Sv/h}$ , submit a "Notice for Works of Decontamination, etc. / Works for Handling Designated Contaminated Soil and Wastes" (Form 2) in advance, to the Labour Standard Inspection Office within the jurisdiction of the workplace of the primary contractor (hereinafter referred to as "the Head of the relevant Labour Standard Inspection Office").

The work notice should be submitted basically for each contract of the work. However, in case several discrete workplaces are included in one work contract, the work notice needs to be submitted for each workplace.

- (2) The work notice should include the description of:
  - (a) Title of the work (Title of the contract of the work).
  - (b) Location of the workplace.
  - (c) Name and address of the Primary contractor.
  - (d) Name and address of the contractee.
  - (e) Duration of the work.
  - (f) Full name of the work leader of the work.
  - (g) Average ambient dose rate at the workplace.
  - (h) List of relevant subcontractors and approximate number of workers for decontamination works.

#### 5 Medical examination by medical doctors

- (1) Employers of decontamination works, etc. should promptly provide workers for decontamination works with medical examination or treatment in any of the following cases:
  - (a) When workers received effective doses higher than the exposure dose limit.
  - (b) When workers inhaled or ingested radioactive materials discharged by the accident by mistake.
  - (c) When workers cannot decontaminate themselves to the level of less than  $40\text{Bq/cm}^2$  by washing and cleaning after being contaminated by radioactive materials discharged by the accident.
  - (d) When a wound is contaminated with radioactive materials discharged by the accident.
- (2) Application of the above (1)-(b) is limited only to the cases in which a certain degree of internal exposure is envisaged. For example, if workers are buried in a large amount of soil and sand, etc. in an accident, etc., and the results of their nasal smear test, etc. show a contamination level over the criterion, or if workers swallow a large amount of soil, sand or contaminated water, etc.

## Section 5 Measures for Preventions of Contamination Spreading and Internal Exposure

### 1 Restriction of dust dispersion

When employers of decontamination works, etc. carry out decontamination works (excluding works for handling designated contaminated soil and wastes), they should take measures to control generation of dust by wetting soil, etc. in advance if the works will be stripping soil, etc. This does not apply when the works are in the category “other than highly radioactive contaminated soil and wastes” or “other than high dust concentration” in the table in Section 3 2-(4).

In order to wet the objects, they should not be dampened using water applied by hoses, etc., but by spraying a mist in order to control generation of contaminated water.

### 2 Use of containers for collecting waste, etc. and measures for storage

(1) When employers of decontamination works, etc. collect, transport and store removed soil or contaminated waste as the work for collecting waste, etc., they should use containers with the structure defined below to prevent removed soil or contaminated waste from dispersing or leaking, and post a sign on the surface of the containers indicating that that removed soil or contaminated waste is inside.

However, provisions described above do not apply as long as measures such as covering them with waterproof sheets are taken to prevent removed soil or contaminated waste from dispersing or leaking, if the objects are extremely difficult to place in a container such as large size machines, logs or dismantled objects bigger than the container, or are a large volume of contaminated soil, etc. which could result in causing a high external radiation exposure or exposure to dust by additional work to subdivide them into containers.

It should be noted that the “work for collecting waste, etc.” does not include the work for moving, back filling and temporary storing of soil generated at the workplace as part of the work for decontaminating soil, etc. or handling designated contaminated soil and wastes.

(a) Containers to be used for collecting or storing removed soil or contaminated waste

1) Containers should be free from a risk of removed soil or contaminated waste being dispersed or leaked.

(b) Containers for transporting removed soil or contaminated waste

1) Containers should be free from a risk of removed soil or contaminated waste being dispersed or leaked.

2) Dose rate (1 cm dose equivalent rate) at the distance of 1 meter from the container surface (from the surface of the package in the case that the container is packed) should not exceed 0.1mSv/h.

In the case of transporting containers by a loading vehicle only, however, the provisions mentioned above do not apply, if the maximum dose rate (1 cm dose equivalent rate) at the distance of 1 meter from the front, rear and both sides of the vehicle (or from the outermost surface of the tire in the case the vehicle is an open type) does not exceed 0.1mSv/h.

- (2) Employers of decontamination works, etc. should take the following measures as well as the measures described in (1) above when storing removed soil or contaminated waste as part of their decontamination works.
  - (a) Post signs to clearly indicate that removed soil or contaminated waste is stored in the area.
  - (b) Install a simple fence using colored pylons, etc. to keep the unauthorized people from the storage area.
- (3) When employers of decontamination works, etc. carry out the works for handling designated contaminated soil and wastes, they should make efforts to remove in advance highly radioactive contaminated soil and wastes in areas where works are to be done, except when reduction of exposure dose is expected to be equal to or better than the removal of contaminated soil and wastes, such as soil covering, paving roads, turning and plowing in farmlands, etc. However the provisions described above should not apply to works to recover local infrastructures that are the minimum required for implementing decontamination such as restoration of water supplies, electricity and roads, etc.

### 3 Implementation of contamination screening

#### (1) Contamination limit

The contamination limit should be set as 40Bq/cm<sup>2</sup> (13,000cpm as a GM counter reading). In case it is difficult to conduct radiation measurement for inspecting contamination due to a high ambient dose rate around the area, the unified contamination screening area in accordance with the provision in Section 4 2-(6) (b) should be set where the ambient dose rate is low enough.

#### (2) Contamination screening for a person who is leaving the controlled area

- (a) Employers of decontamination works, etc. should check the body contamination of workers and equipment worn by the workers such as clothing, footwear, working clothing, and protection equipment at the contamination screening area when they leave the workplace after being engaged in the decontamination work.
- (b) When employers of decontamination works, etc. should find, by the screening, that a worker is contaminated higher than the contamination limit, the employer should not allow the person to leave the workplace until the measures listed below are taken.
  - 1) If the body surface is contaminated, let the person wash his/her body until the contamination level drops to the surface contamination limit or below.
  - 2) If equipment, etc. is contaminated, let the person remove it from his/her body.

#### (3) Contamination screening of objects to be taken from the workplace

- (a) Employers of decontamination works, etc. should check the contamination of objects to be taken from the workplace at the contamination screening area. However this provision should not apply if those objects are encased in containers or covered with plastic sheets to prevent removed soil or contaminated waste inside from dispersing or leaking, for transfer to another workplace for decontamination.
- (b) When employers of decontamination works, etc. find, by screening, that objects are being contaminated at higher than the contamination limit, these objects should not be allowed



to be taken from the workplace. However, this provision does not apply if the object is to be transferred to other facilities such as facilities for decontamination works, storage or disposal or to other decontamination workplaces after necessary measures are taken such as encasement in containers or covering with plastic sheets to prevent the removed soil or contaminated waste from dispersing or leaking.

(c) Contamination screening for vehicles should be conducted after washing off contaminated soil, etc. from the body of the vehicles, by taking note of the following matters:

- 1) Contamination screening is not necessary for the parts such as tires which directly touch the ground, because they can be contaminated again on the driving route even after decontamination to below the contamination limit at the contamination screening area.
- 2) Decontamination is required for the inside and cargo carrier areas, etc. of vehicles other than tires, etc., if the areas are contaminated above the contamination limit.
- 3) It is desirable to decontaminate, and check the contamination, at the unloading place, of the cargo carrier areas, etc. for trucks, etc. which have transported removed soil or contaminated waste. However, if that is difficult, they may be driven back to the contamination screening area again for inspection and decontamination, by covering the carrier areas, etc. with plastic sheets, etc. in order to prevent removed soil or contaminated waste from dispersing or leaking.

#### 4 Measures to prevent contamination

Employers of decontamination works, etc. should take effective measures including those listed below to prevent bodies, equipment or objects from being contaminated beyond the limit;

- (a) Changing shoes, and changing or disposing of clothing, gloves and protection equipment.
- (b) Pre-treating machinery to prevent its contamination, and decontaminating machinery after work.
- (c) Handling treatment for transportation of removed soil, etc.
- (d) Maintaining cleanliness of the workplace.

#### 5 Prevention of body surface and internal contamination

(1) Employers of decontamination works, etc. should provide dust masks with collection efficiencies as given in the table below according to the work categories and radioactivity concentration of soil and wastes or should provide respiratory protective equipment with higher effectiveness, and should direct decontamination workers to wear them when engaged in the works. Decontamination workers should wear the respiratory protective equipment.

	Contaminated soil and wastes with radioactivity concentration higher than 500,000Bq/kg (Highly radioactive contaminated soil and wastes)	Those other than highly radioactive contaminated soil and wastes
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Work under dust concentration higher than 10mg/m <sup>3</sup> (work under a high dust concentration)	Dust collection efficiency: equal to or higher than 95%	Dust collection efficiency: equal to or higher than 80%
Work other than that under a high dust concentration	Dust collection efficiency: equal to or higher than 80%	Dust collection efficiency: equal to or higher than 80%

It should be noted that non-woven fabric masks (that is, masks other than the dust masks certified by the national test, made of non-woven fabric material, and commonly used to prevent colds or pollen allergies, known as surgical masks, pleated masks, and face masks, but excluding gauze masks) may be used instead of dust masks if the work does not involve highly radioactive contaminated soil and wastes nor is it conducted under high dust concentration, and also the work does not fall under Articles 27 (Use of respiratory protective equipment) of the "Ordinance on Prevention of Hazards Due to Dust" (Ministry of Labour Ordinance No.18 of 1979) such as handling grass and trees or leaf mold, etc.

- (2) When decontamination and related works may result in workers becoming contaminated above the contamination limit, the employers of said workers shall keep the following matters in mind and shall instruct their workers in performing such decontamination works to wear appropriate protective clothing, gloves, or shoes, for preventing contamination, according to work categories and radioactivity concentration of soil and wastes given in the table below. The workers so instructed shall wear such protective gear.
- (a) Gloves made of material less likely to cause allergies should be prepared if needed, because some types of rubber glove material may cause allergic symptoms.
  - (b) Measures such as shoes covered by plastic, etc. may be required in the case that wearing rubber boots is difficult to use due to the nature of the work.
  - (c) Waterproof clothing such as raincoats, etc. should be worn as appropriate when using water for high-pressure cleaning, etc.

	Contaminated soil and wastes with radioactivity concentration higher than 500,000Bq/kg (Highly radioactive contaminated soil and wastes)	Those other than highly radioactive contaminated soil and wastes
Work under dust concentration higher than 10mg/m <sup>3</sup> (work under a high dust concentration)	Whole body chemical protective clothing to cover long sleeve shirts (for example, air-tight Tyvek suits), rubber gloves (over cotton gloves), rubber boots	Long sleeve shirts, cotton gloves, rubber boots
Work other than under a high dust concentration	Long sleeve shirts, rubber gloves (over cotton gloves), rubber boots	Long sleeve shirts, cotton gloves, rubber boots

- (3) When the protective gear to be used by workers for decontamination and related works is

contaminated above the contamination limit (40Bq/cm<sup>2</sup> (13,000 cpm as a GM counter reading)), employers of said decontamination related workers shall not allow the workers to use such protective gear, unless it is decontaminated by washing or cleaning to the level of or lower than the said contamination limit.

Disposable type dust masks or non-woven masks should be discarded at the end of work each day. If a mask is taken off during a break in the day, the mask should be stored properly so that the inner side of the mask will not be contaminated with dust or soil, etc. or it should be discarded. If a dust mask is an exchangeable type, the filter should be discarded at the end of work each day and the mask face piece should be cleaned according to the instructions by the manufacturer. During cleaning, dust and sweat should not be left on the surface of the face piece, and replaceable parts such as exhaust and intake valves and lacing should be checked for any dirt or damage. If required, they should be replaced with new parts before the next use.

- (4) Employers of decontamination works, etc. should prohibit workers from smoking, eating and drinking in areas other than the area designated in Section 4 2-(5) and they should inform workers about this in writing such as by a letter or posting a notice. Workers should not smoke or eat and drink in the non-designated areas.

## Section 6 Education for Workers

### 1 Education for operation leaders

- (1) When employers of decontamination works, etc. appoint an operation leader for the decontamination works (for the works for handling designated contaminated soil and wastes, they are limited to those in the workplaces where average ambient dose rate exceeds 2.5 $\mu$ Sv/h), they should provide education to the operation leader with the following courses:
  - (a) How to determine work procedures and arrange workers engaged in decontamination works.
  - (b) How to direct workers engaged in decontamination works.
  - (c) Measures in case of abnormal events.
- (2) See the Attachment 7 for details in implementing the education.

### 2 Special education for the workers engaged in decontamination works

- (1) Employers of decontamination works, etc. should provide special education consisting of lectures and practical training with respect to the following courses to the workers engaged in decontamination works before assigning them to decontamination works.
  - (a) Lectures
    - 1) Knowledge about the effects of ionizing radiation on human body and exposure dose control methods
    - 2) Knowledge about the methods of decontamination related works
    - 3) Knowledge about the structure and handling of the machinery, etc. used for

decontamination related works (except for the works for handling designated contaminated soil and wastes)

- 4) Names and intended use of the machinery, etc. used for decontamination related works (limited only to the works for handling designated contaminated soil and wastes)
- 5) Relevant laws and regulations

(b) Practical training

- 1) Methods of decontamination and handling machinery, etc. used for decontamination related works (except for the works for handling designated contaminated soil and wastes)
- 2) Methods of decontamination related works (limited only to the works for handling designated contaminated soil and wastes.)

(2) See Attachment 8 for details in implementing the special education.

3 Education, etc. for other workers who require education

- (1) Employers other than employers of decontamination works, etc. who conduct decontamination related works of their own sites or facilities, etc., or employers who conduct decontamination related works in other than the special decontamination areas, etc. should provide education to workers necessary for conducting decontamination related works. It is desirable to provide education as well to those who are not employed by the employers of decontamination works, etc. themselves such as individual proprietors, self-employed workers and volunteers, etc.
- (2) It is desirable that the ordering parties place an order for decontamination works only after confirming that employers of decontamination works, etc. have established a system to secure the required number of educated operation leaders and workers sufficient to conduct the work.

Section 7 Measures for Health Care

1 Special medical examination

- (1) Employers of decontamination works, etc. should provide the workers regularly engaged in decontamination works (for the works for handling designated contaminated soil and wastes., they are limited to those in the workplaces with the average ambient dose rate exceeding  $2.5\mu\text{Sv/h}$ ) with the following medical examinations by medical doctors at the time of employment or of being transferred to the work, and once within every 6 months thereafter on a regular basis.

It should be noted that for workers with less than a 6-month-contract or a dispatched contract or dispatched workers, the medical examinations should be also provided at the time of employment in order to acquire their exposure history and health condition.

- (a) Inquiry and assessment of their exposure history (their work location, work descriptions and durations, whether they have subjective symptoms or not, and other relevant matters regarding radiation exposure for workers who have an exposure history)

- (b) White blood cell count and differential white blood cell count
  - (c) Red blood cell count and hemoglobin or hematocrit value
  - (d) Eye inspection for cataracts
  - (e) Skin inspection
- (2) Regardless of the definition in (1) above, the tests (b) to (e) in (1) are not required, if a medical doctor considers so, for a worker whose medical examination (provided on a regular basis) of the previous year show that the effective dose was less than 5mSv, and whose medical examination of the present year shows that effective dose will unlikely exceed 5mSv.
- (3) Employers of decontamination works, etc. should prepare the “ionizing radiation medical examination cards for decontamination, etc.” (Form 3) based on the results of medical examinations in (1) above and keep them for 30 years. It should be noted, however, that this shall not be applicable if the records are transferred to the organization designated by the Minister of Health, Labour and Welfare (Radiation Effects Association, a public interest incorporated foundation) after the records have been kept for five years or the workers engaged in decontamination works recorded therein have left the job.

## 2 General medical examinations

- (1) Employers of decontamination works, etc. (for dispatched workers, their employer should provide a general medical examination and the same should apply hereafter) should provide the workers engaged in decontamination works who will be regularly engaged in decontamination works (for the works for handling designated contaminated soil and wastes, they are limited to those in the workplaces where average ambient dose rate exceeds 2.5 $\mu$ Sv/h) with the following medical examinations by medical doctors at the time of employment or of being transferred to the work, and once within every 6 months thereafter on a regular basis.
- (a) Inquiry for medical history and work history
  - (b) Inquiry for subjective and objective symptoms
  - (c) Measurement of height, weight and waist and visual and hearing acuity tests
  - (d) Thoracic spine X-ray examination and sputum test
  - (e) Measurement of blood pressure
  - (f) Anemia test
  - (g) Liver function tests
  - (h) Lipid blood tests
  - (i) Glucose test
  - (j) Urine test
  - (k) Electrocardiography
- (2) Employers of decontamination works, etc. should provide decontamination workers who will be regularly engaged in the works for handling designated contaminated soil and wastes except for (1) above, with the medical examination for the tests (a) to (k) in (1) by a medical doctor at the time of employment or of being transferred to the work, and once within every one year thereafter on a regular basis.

- (3) Regarding medical examinations for (1) or (2) above (limited to those on a regular basis), workers who were examined for items (f) through (i) and (k) of the above (1) at the previous medical examination may be exempted from all or part of such items, if the occupational physician considers them unnecessary.
- (4) As for items (c), (d), (f) through (i) and (k) of the above (1), they may be omitted if the occupational physician considers them unnecessary based on the criteria set by the Minister of Health, Labour and Welfare.
- (5) The hearing test of item (c) of the above (1) (limited to tests conducted during regular medical examinations) may be substituted by hearing tests that the occupational physician considers appropriate (excluding tests for hearing ability for 1000 Hz and 4000 Hz sounds), for workers who were examined for the said items during the previous medical examination, or who are younger than 45 years (except those aged 35 and 40 years old).
- (6) Employers of decontamination works, etc. should prepare the medical examination card, based on the results of the medical examination in (1) or (2) and keep them for 5 years.

### 3 Subsequent actions on the results of the medical examination

- (1) Employers of decontamination works, etc. should seek opinions from the medical doctor about the results of the medical examination described in 1 or 2 above (limited to workers who were diagnosed as abnormal in the said medical examinations items) in the following manner.
  - (a) A medical doctor's opinion should be sought within three months from the date of a medical examination.
  - (b) The opinions and observations of the medical doctor should be recorded in each employee's personal medical examination card.
- (2) Employers of workers engaged in decontamination works, etc. should inform those workers for decontamination and related works who had the said examinations of their medical examination results without delay.
- (3) Employers of workers engaged in decontamination works, etc., when the medical examinations described in 1 above (limited to those conducted regularly) have been conducted, should submit the "Report of results on the ionizing radiation medical examinations for decontamination, etc." to the relevant Head of the Labour Standards Inspection Office without delay.
- (4) When a worker has, or is suspected to have, or may have a radiation hazard ailment based on the results of the medical examinations described in 1 or 2 above, the employers of the workers engaged in decontamination works, etc. should take the necessary measures to maintain the health of the worker including transferring him/her to another workplace or changing the specific work, minimizing the radiation exposure time and changing the method of work and so forth, until there are no doubts about the worker's radiation hazard ailment or its possibility.

### 4 Transfer of the records

- (1) When any employer of decontamination works, etc. intends to discontinue its operation, the ionizing radiation medical examination cards for decontamination, etc. defined in 1-(3) above should be transferred to the organization designated by the Minister of Health, Labour and Welfare (Radiation Effects Association, a public interest incorporated foundation).
- (2) Employers of decontamination works, etc. should issue copies of the ionizing radiation medical examination card for decontamination, etc. defined in 1-(3) above to the worker who is going to leave the job or to all of the workers when the business is terminated.

## Section 8 Safety and Health Management System

### 1 Establishment of the safety and health management system by the primary contractors

#### (1) Appointing a general safety and health manager

The primary contractors should appoint a general safety and health manager among the individuals who supervise and manage the decontamination works, and assign him/her to conduct tasks (2) to (4) shown below in order to ensure appropriate safety and health management for the decontamination works.

#### (2) Appointing a person responsible for safety and health control in relevant subcontractors

The primary contractor should require the relevant subcontractors to assign a person responsible for safety and health control to conduct the following tasks.

- (a) Communication with the general safety and health manager.
- (b) Coordination with the general safety and health manager to ensure the following matters are conducted smoothly among the relevant subcontractors.
- (c) Communication and coordination with all of the relevant subcontractors when the relevant subcontractors assign part of their work to other subcontractors.

#### (3) Holding the safety and health coordinating meeting consisting of all relevant subcontractors, etc.

- (a) The safety and health coordinating meeting consisting of all relevant subcontractors should be established and the meetings should be held once within a month on a regular basis.
- (b) The following matters should be discussed at the safety and health coordinating meeting:
  - 1) Implementation of education necessary for safety and health management such as special educations for workers who are newly engaged in the decontamination works.
  - 2) Implementation of preliminary surveys, and preparation and improvement of work plans.
  - 3) Setting of contamination inspection areas and implementation of contamination inspections.
  - 4) Emergency communications and actions in case of abnormal events including occurrence of occupational hazards.

#### (4) Guidance and support for preparing work plans, etc.

- (a) The general safety and health manager should guide, or support the relevant

subcontractors as appropriate to ensure that the relevant subcontractors conduct a preliminary survey, and prepare work plans appropriately.

- (b) The general safety and health manager should guide, or support the relevant subcontractors as appropriate to ensure that the relevant subcontractors inform their workers about the results of the preliminary survey and details of the work plans appropriately.

## 2 Consolidated management of radiation exposures by the primary contractor

The primary contractor should assign a radiation administrator to conduct radiation dose control specified in Sections 3-2 through 3-4 and assign the radiation administrator to consolidate radiation exposure management for all workers from the relevant subcontractors under the direction of the general safety and health manager in the paragraph 1-(1) by taking into account the following matters, in order to ensure that radiation exposure is controlled appropriately.

It is recommended that the radiation administrator be selected from among those who have radiation-related national qualifications, or those who have been trained through courses regarding radiation management at professional educational institutions.

- (1) Implement setting of the contamination inspection area and contamination inspections appropriately upon consulting with the ordering party.
- (2) Guide or support the persons in charge of radiation administration from the relevant subcontractors to ensure that the relevant subcontractors take measures stated in Sections 3-2 through 3-4 and Section 8-4 appropriately.
- (3) Take part in the Organization for Registration Control of Radiation Exposure Doses for Decontamination and Related Works in order to properly determine the accumulated exposure doses of workers and to prevent exposure dose records from getting scattered or lost.
- (4) Implement any other tasks necessary for radiation control.

## 3 Safety and health management system by employers of decontamination works, etc

- (1) Employers of decontamination works, etc. should appoint health managers or safety and health promoters to assign administration of technical matters stated in Sections 3-2 and 3-4 (Dose measurement and records of dose measurement, etc.), Section 5-3 (Contamination inspection, etc.), Sections 5-4 and 5-5 (Prevention for body and internal contamination), Section 6 (Education for workers) and Section 7 (Measures for health care).

It is desirable to appoint a safety and health promoter even if the number of workers is less than 10.

- (2) Employers of decontamination works, etc. should appoint a person in charge of radiation administration regardless of the size of workplaces to assign him/her to conduct those tasks stated in Sections 3-2 and 3-4 (Dose measurement and records of dose measurement results, etc.), Section 5-3 (Contamination inspection, etc.), Sections 5-4 and 5-5 (Prevention for body and internal contamination).



4 Measures for maintaining and promoting the health of emergency workers at the TEPCO Fukushima Daiichi Nuclear Power Plant

Employers of decontamination works, etc. should implement the following matters, when they assign the workers who had been engaged in the emergency work at the TEPCO Fukushima Daiichi Nuclear Power Plant to the decontamination works.

- (1) A report pursuant to Article 59, Paragraph 2 of the Ionizing Radiation Ordinance should be submitted to the Minister of Health, Labour and Welfare (c/o Office of Workers Health Planning for Ionizing Radiation, Industrial Health Division, Industrial Safety and Health Department, Labour Standards Bureau, Ministry of Health, Labour and Welfare).
  - (a) Copies of the medical examination card stated in Sections 7-1-(3) and 7-2-(4) should be submitted after medical examination without delay.
  - (b) The “status report on radiation dose control, etc. for designated emergency workers” (the Ionizing Radiation Ordinance Form No.3) shall be submitted at the end of every three months. The submission shall, in principle, be in an electromagnetic form as CSV file format.
- (2) Health guidance should be provided to workers generally and inspections required by the guideline should be implemented for workers having received exposure dose greater than 50mSv during the period of the emergency operation in accordance with the “Guideline for Maintaining and Promoting the Health of Emergency Workers at the TEPCO Fukushima Daiichi Nuclear Power Plant” (Bulletin No. 5 of 2011).

Attachment 1. List of special decontamination areas ,etc.

1. Special decontamination areas

- Designated areas  
Areas, etc. included in Former Restricted Areas and Deliberate Evacuation Areas

	Number of municipalities	Designated areas
Fukushima Prefecture	11	All areas in Naraha-town, Tomioka-town, Okuma-town, Futaba-town, Namie-town, Katsurao-village and Iitate-village. And areas that used to be designated as Warning Zones or Planned Evacuation Zones in Tamura-city, Minamisoma-city, Kawamata-town and Kawauchi-village.

2. Intensive contamination survey areas

- Designated areas  
Areas for which the radiation dose rate is 0.23 $\mu$ Sv/h or above

	Number of municipalities	Designated areas
Iwate Prefecture	3	All areas in Ichinoseki-city, Oshu-city, and Hiraizumi-town
Miyagi Prefecture	8	All area of Shiroishi-city, Kakuda-city, Kurihara-city, Shichikashuku-town, Ogawara-town, Marumori-town, Watari-town, and Yamamoto-town
Fukushima Prefecture	36	All areas in Fukushima-city, Koriyama-city, Iwaki-city, Shirakawa-city, Sukagawa-city, Soma-city, Nihonmatsu-city, Date-city, Motomiya-city, Koori-town, Kunimi-town, Otama-village, Kagamiishi-town, Tenei-village, Aizubange-town, Yugawa-village, Aizumisato-town, Nishigo-village, Izumizaki-village, Nakajima-village, Yabuki-town, Tanagura-town, Samegawa-village, Ishikawa-town, Tamakawa-village, Hirata-village, Asakawa-town, Furudono-town, Miharu-town, Ono-town, Hirono-town and Shinchi-town; and areas excluding the restricted and designated areas in Tamura-city, Minamisoma-city, Kawamata-town, and Kawauchi-village
Ibaraki Prefecture	19	All areas in Hitachi-city, Tsuchiura-city, Ryugasaki-city, Joso-city, Hitachiota-city, Takahagi-city, Kitaibaraki-city, Toride-city, Ushiku-city, Tsukuba-city, Hitachinaka-city, Kashima-city, Moriya-city, Inashiki-city, Hokota-city, Tsukubamirai-city, Tokai-village, Miho-village, Ami-town, and Tone-town
Tochigi Prefecture	7	All areas in Kanuma-city, Nikko-city, Ohtawara-city, Yaita-city, Nasushiobara-city, Shioya-town, and Nasu-town
Gunma Prefecture	8	All areas in Kiryu-city, Numata-city, Shibukawa-city, Midori-city, Shimonita-town, Takayama-village, Higashiagatsuma-town, Kawaba-village
Saitama Prefecture	2	All areas in Misato-city and Yoshikawa-city

Chiba Prefecture	9	All areas in Matsudo-city, Noda-city, Sakura-city, Kashiwa-city, Nagareyama-city, Abiko-city, Kamagaya-city, Inzai-city, and Shiroy-city
Total	92	

\* Prepared by Division of Environmental Restoration, Environmental Restoration and Resources Recycling Bureau, Ministry of the Environment (January 2018)

Attachment 2. Specific activities (works) prohibited for dispatched workers among decontamination works

No person should be allowed to carry out a Worker Dispatching Undertaking with regard to services falling under construction work (which refers to work relating to civil engineering, and construction, remodeling, maintenance, repairing, modification, wrecking or dismantling of buildings and other structures, or preparation for any of these ; hereinafter referred to as “civil engineering/construction work”) pursuant to the provisions of Article 4, Paragraph 1 of the “Act for Securing the Proper Operation of Worker Dispatching Undertakings and Improved Working Conditions for Dispatched Workers.” Thus among decontamination works, those that fall under construction work of any of the above items, are not allowed to engage dispatched workers.

Therefore generally, if dispatched workers are employed at the construction site, their works are mainly considered as preparation for civil engineering/construction works. Thus they are, in most cases, prohibited although the work may not be defined as construction work when conducted independently.

For reference, several examples are shown in the following, but in principle, it should be judged whether or not decontamination works fall under construction work in line with the actual situation. In addition, it should be noted that even though the work may not be defined as civil engineering/construction work when conducted independently, they fall under civil engineering/construction work, and accordingly are prohibited because they are considered as preparation for the civil engineering/construction work.

Description of works (Machinery used, etc.)	Whether or not allowed
Decontamination of forests (removal of fallen leaves, branches and leaves, etc. and pruning of trees) (Electric saws)	Generally, the work on the left is allowed. However, when it is practically conducted as preparation for civil engineering or construction, etc., it falls under construction services, and accordingly is not allowed.
Watering of soil, etc. (Hoses, etc.)	Generally, the work is allowed as long as it is completed independently. However, when it is practically conducted as preparation for civil engineering or construction, etc., it falls under construction services, and accordingly is not allowed.
Mowing, stripping of topsoil, removal of soil, grass, moss, fallen branches and leaves, and garbage (Mowers, shovels, brooms, rakes, and sandbags)	Generally, mowing and removal of grass, moss, and fallen branches are allowed. However, when they are practically conducted as preparation for civil engineering or construction, etc. they fall under construction services, accordingly are not allowed. In addition, stripping of topsoil and removal of soil are considered as construction services themselves, and accordingly are not allowed.

Stripping of topsoil, etc., removal of soil, grass, moss, fallen branches and leaves, and garbage (Heavy machines, such as backhoes, and sandbags)	They are not allowed because they are considered as construction services themselves.
Removal of sludge in gutters, etc. (Shovels, brooms, rakes, and sandbags)	Generally, the work is allowed as long as it is completed independently. However, when it is practically conducted as preparation for civil engineering or construction, etc., it falls under construction services, and accordingly is not allowed.
Cleaning of roofs, walls, roads and gutters, etc. (High-pressure washing machines, brushes, buckets, and rags)	Generally, the work is allowed as long as it is completed independently. However, when it is practically conducted as preparation for civil engineering or construction, etc., it falls under construction services, and accordingly is not allowed.
Temporary storage and burial of removed soil, etc. (Shovels, sandbags, impermeable sheets, and shields)	Burial of removed soil, etc. on the left is not allowed because it is considered as a construction service itself. For temporary storage of removed soil, etc., it is generally allowed as long as the work is simply transferring removed and accumulated soil. However, in most cases, it is practically conducted as preparation for civil engineering or construction, etc., therefore it falls under construction services.
Transfer of removed soil, etc. to temporary storage places, etc. (Backhoes)	It is not allowed because it is considered as a construction service itself.
Transport of removed soil, etc. (Transportation vehicles)	It is not allowed when the work on the left is to transport removed soil, etc. directly from areas where the soil is because it is practically conducted as preparation for civil engineering or construction, etc. in most cases, and therefore it falls under construction services. On the other hand, it is allowed to transport removed soil from a temporary storage yard as a secondary purpose.
Stripping of roof tiles and side walls of buildings (Various tools)	It is not allowed because it is considered as a construction service itself.
Stripping of asphalt (Electric cutters)	It is not allowed because it is considered as a construction service itself.
Removal and transportation of debris	These are allowed when they refer to removal by manual labour of: debris which is not fixed firmly; sediment that flowed into residences; or sediment and debris left behind on the ground or on roads. However, when these are conducted by using heavy work machines or as preparation for civil engineering or construction, etc., they fall under construction services, and accordingly are not allowed.

### Attachment 3. Determination on whether or not the work falls under the category of work under high dust concentration

#### 1 Objectives

The purpose of the determination on whether or not the work falls under the category of work under high dust concentration is for employers to find out if a high concentration of dust that exceeds the lower limit of 10 mg/m<sup>3</sup> is generated during the work, and accordingly to determine the measurement method to control internal exposure.

#### 2 Basic Policy

- (1) A simplified measurement instead of an accurate one is acceptable so long as it can determine whether or not the dust concentration exceeds the lower limit of 10 mg/m<sup>3</sup> as a high dust concentration.
- (2) It is desirable that carrying out the measurement be commissioned to experts.

#### 3 Measurement method

- (1) A personal sampler should be used during the work in order to determine whether or not the work falls under the work under high dust concentration; the measurement should be based on the relative concentration indication method using a digital dust meter, in principle, measured near workers during the work that generates dust.
- (2) Measurement should follow the procedures described below:
  - (a) Relative concentration (cpm) should be measured for 2 - 3 minutes using a digital dust meter (e.g., LD-5) in the vicinity of workers (downwind), to the extent that it does not disturb the workers engaged in the dust generating work.
  - (b) It is desirable to conduct the measurement of the relative concentration described in (a) for all of the workers engaged in the work. However, when several workers are engaged in similar tasks within a distance of several meters, it may be sufficient to measure for a representative worker of the group.
  - (c) Both a digital dust meter and an inhalable dust concentration measurement device should be set in parallel in the vicinity (downwind), to the extent that they do not disturb the work, of the worker for whom the simplified measurement in (a) showed the highest relative concentration (cpm), and the concentration should be measured for 10 minutes or longer continuously to obtain a mass-concentration conversion factor.
    - 1) The concerned particles for the dust concentration measurement should be airborne inhalable dust (respiratory dust, particle diameter 100 µm, 50% cut) that could be inhaled through a person's nose or mouth.
    - 2) The concentration of the inhalable dust should be measured using an open-face type of sampler at the face-velocity of 19 (cm/s) on a sampling filter paper.
    - 3) Article 2 of the Working Environment Measurement Standards (Ministry of Labour Notification No. 46 of 1976) should be followed, except for the specifications of dust particle diameters of the dust particle separators and the measurement positions.

- (3) Dust particle concentrations ( $\text{mg}/\text{m}^3$ ) should be calculated from the relative concentration measurements (a) using a mass-concentration conversion factor obtained from the result in (c). In the case that the highest value of the measurements exceeds  $10 \text{ mg}/\text{m}^3$ , the concentration in the environment for all other workers engaged in the same task should be considered as exceeding  $10 \text{ mg}/\text{m}^3$ .

#### 4 Measurement method (when using the specified mass-concentration conversion factor)

##### (1) Applied conditions

This measurement method should be applied only for handling soil mainly. Items which contain a large quantity of organic matters, including fallen leaves and branches, paddy straws, grasses, supply/sewage water sludge and items such as rubble, construction waste, etc. which contain a large amount of dust other than soil should be handled in accordance with the measurement method set forth in Section 3.

##### (2) Setting of measuring points

- (a) The measurement during works under high dust concentration should be conducted in principle by the relative concentration indication method using a digital dust meter in the vicinity of workers engaged in dust generating work. The measuring positions should be the spots where the dust concentration is assumed to be the highest, in the downwind of dust generating source, and where the exhaust gas from heavy machines, etc. is less likely to affect the measurement. The concentration should be measured for all works during which dust is expected to be generated.
- (b) When several workers are engaged in the same task, the measurement should be performed for a representative worker of the group.
- (c) The measurement should be conducted as closely as possible to workers to an extent that it does not disturb the works and the safety of a measurer be ensured. If possible, it is desirable that the measurer take a digital dust meter with him and conduct the measurement as closest position as possible to the workers. If there should be no safety problems concerning the work, it is also possible that the workers themselves conduct measurement carrying the LD-6N on them.

##### (3) Measuring time

- (a) The measuring time should be continuously for 10 minutes or longer during work at which the concentration is estimated to be the highest. If works are repeatedly carried out for short cycles of a few minutes each, the measurement should be made for a period of at least 10 minutes including the time which the works are being underway.
- (b) If one work cycle is somewhere between 10 minutes and one hour, the measurement should be made for the entire cycle. If a work is continued longer than that, the concentration should be measured several times for about a period of 10 minutes during the work and the highest value should be recorded.

##### (4) Evaluation

- (a) The relative concentration value indicated by the digital dust meter (the number counted per minute: cpm) is multiplied by the mass-concentration conversion factor to obtain the

mass concentration and whether or not the value is exceeding  $10 \text{ mg/m}^3$  should be determined.

(b) The mass-concentration conversion factor

The mass concentration conversion factor in this measurement method should be set to  $0.15 \text{ mg/m}^3/\text{cpm}$ . However, note the following items when using the factor.

- 1) Because the factor is set based on the results of limited measurements, it should be reviewed appropriately in step with the advancement of future research.
- 2) It is assumed that this factor will be applied to the digital dust meter of light scattering method, the LD-5 and LD-6.



## Attachment 4. Internal exposure screening test method

### 1 Objectives

Screening tests are conducted by employers of decontamination works, etc to judge if they are required to provide workers with measurement of internal exposure.

### 2 Basic policy

(1) For works under a high dust concentration ( $10\text{mg}/\text{m}^3$ ) environment and involving handling of highly radioactive contaminated soil ( $500,000\text{Bq}/\text{kg}$ ), internal exposures exceeding the effective dose of  $1\text{mSv}/\text{y}$  could be expected assuming that works were conducted under an unprotected situation condition without wearing a dust mask. Therefore measurement of internal exposure should be conducted once within every three months for the workers engaged in such works.

(2) For other workers other than the above, the screening test should be conducted when the work of the day is finished, and if the screening test result suggests a higher dose than the limit, measurement of internal exposure should be conducted once within every three months.

In the case that the works are not conducted under a high dust concentration ( $10\text{mg}/\text{m}^3$ ) environment or involving handling of highly radioactive contaminated soil ( $500,000\text{Bq}/\text{kg}$ ), the maximum value of internal exposure is estimated not to exceed  $0.153\text{mSv}/\text{y}$ , so internal exposure measurement should be conducted only when incidentally exposed to high dust concentration .

### 3 Screening test methods

(1) Screening tests should be conducted as follows:

- (a) Radioactivity density on the surface of the mask should be measured with a radiation counter when the work of the day is completed.
- (b) Radioactivity density in the intranasal area should be measured (nasal smear test) with a radiation counter when the work of the day is completed.

(2) The criteria for the screening tests should be that the radioactivity density on the surface of the mask and in the intranasal area should be low enough to ensure that the internal exposure of the workers engaged in decontamination works is well below  $1\text{mSv}$  per three-month.

Reference values are as follows:

- (a)  $10,000$  cpm on the surface of a mask for the screening test (this is equivalent to  $0.01\text{mSv}$  based on the calculation using a protection coefficient of 2 instead of 3 which is normally used (with severer assumption), and assuming that 50 % of the radioactive materials were attached on the mask surface, and the other 50 % were inhaled).
- (b)  $1,000$  cpm (equivalent to approximately  $0.03\text{mSv}$  of internal effective dose) and  $10,000$  cpm (equivalent to approximately  $0.3\text{mSv}$  of internal effective dose) for the nasal smear test which is assumed to be conducted as a secondary screening test.

(3) Actions after the screening tests

- (a) In the case that the result of the test for a dust mask exceeds the criterion, the nasal smear test should be conducted.

- 1) In the case that nasal smear test exceeds 10,000cpm, internal exposure should be measured once within every three months. For female workers who have been clinically confirmed as having a capability to become pregnant, internal exposure should be measured immediately when the nasal smear test exceeds the criterion.
  - 2) In the case that the nasal smear test result exceeds 1,000cpm but is equal to 10,000cpm or less, the results are recorded. In case that the nasal smear test result exceeds 1,000cpm several times, then the internal exposure should be measured once within every three months.
- (b) In the measurement of the dose rate on the surface of a dust mask as specified in (1)-b, when the surface radioactivity density of a specific worker shows a drastically lower value than that of other workers who do the same work, instruction on how to properly wear a dust mask should be provided to the worker, because the surface radioactivity density tends to show lower values due to improper wearing of the dust mask.

## Attachment 5. Methods of measurement and evaluation of average ambient dose rate

### 1 Objectives

The purposes of measurement and evaluation of average ambient dose rates are for employers of decontamination works, etc. to measure and evaluate whether or not the average ambient dose rate at a workplace exceeds  $2.5\mu\text{Sv/h}$ , and accordingly to determine the details of radiation dose control to be implemented when employers assign workers to the decontamination works.

### 2 Basic policy

- (1) Average ambient dose rate should be measured prior to commencing the work.
- (2) When conducting the works for handling designated contaminated soil and wastes and work that is on-going at the same place, the dose rate should be measured once every two weeks as well as prior to commencing the work. Even when the measured dose rate is equal to  $2.5\mu\text{Sv/h}$  or less, the measurements should be continued until the dose rate falls below approximately 90% of  $2.5\mu\text{Sv/h}$  ( $2.2\mu\text{Sv/h}$ ). Also, the dose rate should be measured when there are significant changes in the surrounding environment due to typhoons, flooding or land slippage.
- (3) The measurement should appropriately reflect the actual exposure situation of workers.

### 3 Measurement and evaluation of average ambient dose rate

- (1) Common subjects
  - (a) Average ambient dose rate should be measured at a point 1m above the ground.
  - (b) The measuring device should comply with Article 8 of the Working Environmental Measurement Standards.
- (2) When small scattering of ambient dose rate is expected (except for the works for handling designated contaminated soil and wastes.)
  - (a) When the working area is a rectangular shape, ambient dose rate should be measured at the four corners and at the intersection of the two diagonal lines of the rectangle. (Working area refers to each of the sub-divisions of the original working area, which are less than  $1,000\text{ m}^2$ , if the size of the working area is greater than  $1,000\text{m}^2$ .) Average ambient dose rate is derived by averaging the measurements from these five points.
  - (b) When the working area is not rectangular in shape, the ambient dose rates should be measured at four points set at almost equal distances along the outer periphery and one intersection point of the two diagonal lines from facing points. The average ambient dose rate is derived by averaging the measurements at these five points.
- (3) When small scattering of the ambient dose rate is expected (except for the works for handling designated contaminated soil and wastes.)
  - (a) Ambient dose rate should be measured at three different points at least where the dose rate is likely to be the highest in the working area. Average ambient dose rate is derived by averaging the measurements from three points.
  - (b) In the case the area was decontaminated in advance and contaminated soil etc. with high

concentration of radioactive materials has been removed, this is basically considered as the case with small scattering of ambient dose rate

(4) When large scattering of ambient dose rate is expected:

(a) Average dose rate should be calculated according to the formula shown below regardless of the provision in (2) when radioactive materials are concentrated at a certain place in the work area resulting in a significant difference in the ambient dose rate from that in other work areas.

(b) The following matters should be noted:

(i) Ambient dose rate should be measured at several points every 1,000 m<sup>2</sup> around the points where a higher dose rate is expected (hereafter referred to as “specified measuring points”).

(ii) Exposure dose should be calculated for a representative individual for whom the highest dose is expected.

(iii) When the work continues several days at the same place, the calculation should be done assuming the day when the work is conducted is the day with the highest exposure dose.;

$$R = \left( \sum_{i=1}^n (B^i \times WH^i) + A \times (WH - \sum_{i=1}^n (WH^i)) \right) \div WH$$

where,

*R*: average ambient dose rate (μSv/h);

*n*: number of specified measuring points;

*A*: average ambient dose rate (μSv/h) calculated according to (2);

*B<sup>i</sup>*: ambient dose rate values at each specified measuring point (μSv/h); to be put in the formula to obtain *R*;

*WH<sup>i</sup>*: working hours (h) at the place of concern of a worker whose exposure dose is expected to be the highest among the workers engaged in decontamination works who carry out the decontamination works at the place near each specified measuring point;

*WH*: working hours (h) in a day for the concerned decontamination works.

Attachment 6. Measurement methods for radioactivity concentration in the contaminated soil and wastes.

## 1 Objectives

The objectives of measuring radioactivity concentration of contaminated soil and wastes, removed soil or contaminated waste are to assist employers in determining whether the contaminated soil and wastes exceeds the reference value (10,000Bq/kg or 500,000Bq/kg) and in deciding the necessary radiation protection measures for assigning their workers to the decontamination works.

## 2 Basic policy

- (1) Radioactivity concentration should be measured prior to commencing the works.
- (2) When conducting the works for handling designated contaminated soil and wastes and work that is on-going at the same place, the radioactivity concentration should be measured once every two weeks as well as prior to commencing the works. When the measured radioactivity concentration is below 10,000Bq/kg, the measurements should be continued until consistent low measurements can be obtained (approximately 10 weeks) considering the fluctuation of the measurements, except in the case that the measurement is clearly lower than 10,000Bq/kg. Also, the radioactivity concentration should be measured when there are significant changes in the surrounding environment due to typhoons, flooding or land slippage.
- (3) It is desirable that the measurement be commissioned to experts.
- (4) The radioactivity concentration should be measured for soil, etc. to be actually handled in the works.
- (5) The highest value among measurements should be selected as a representative one considering the large variability of radioactivity concentration.
- (6) The measurement before commencing the works should be based on the methods shown in Attachment 6-2 or the lookup table in Attachment 6-3, or other knowledge. The provision here does not require the measurement of radioactivity concentration when it can be clearly determined that the radioactivity concentration of contaminated soil and wastes involved in the work is significantly lower than 10,000Bq/kg, and the works do not fall under those for handling designated contaminated soil and wastes.

## 3 Sampling

- (1) Principles for sampling
  - (a) Either one of following materials should be sampled:
    - (i) Contaminated soil, removed soil or contaminated waste in the location where the highest ambient dose rate was observed among air dose measurement points of the workplace; or
    - (ii) Those samples considered to have the highest radioactivity concentrations, among contaminated soil, removed soil or contaminated waste to be handled during the works.
  - (b) Several materials should be sampled from each workplace (every 1,000 m<sup>2</sup> when the size

of the workplace is larger than 1,000m<sup>2</sup>). For the workplace whose size is significantly larger than 1,000m<sup>2</sup> and where radioactivity concentrations are relatively consistent for farmland, contaminated soil and wastes, removed soil or contaminated waste, the number of materials to be sampled may be considered as at least one for every 1,000m<sup>2</sup>.

- (c) Average radioactivity concentration should be determined for sampled materials when soil is sampled at different depths up to a certain depth from the surface.

(2) Location of sampling (except works for handling specified contaminated soil and wastes.)

Areas to be decontaminated with potentially high radioactivity concentration include the following:

(a) Farmland

Soil in the zone up to 5 cm in depth from the surface

(b) Forest

(i) Representative leaves and bark of trees , and fallen leaves and branches

(ii) Leaf mold in the zone up to 3cm in depth in the fallen leaf layer (leaf mold)

(c) Living environment (Areas around structures such as buildings or roads)

The area where rain water is collected and where the collected rain water exits, plants and their roots, locations where rainwater, mud or soil tend to be accumulated, and removed objects such as sludge near the structures to which small particles tend to be attached

(3) Location of sampling (limited to the works for handling specified contaminated soil and wastes)

(a) Farmland

Soil in the zone up to 15cm in depth from the surface.

(b) Forest

Leaves of trees, bark, and fallen leaves and branches whose potential radioactivity concentration is expected to be the highest. (When measuring the fallen leaf layer (leaf mold), soil up to 15cm in depth including the soil beneath the layer should be measured.)

(c) Living environment (Areas around the structures such as buildings or roads)

The soil, etc. among those items to be handled in the works, accumulated in the places, where rain water flows in and out, where there are plants and their roots, and where rain water, mud and soil tend to pool, and those of the places near structures to which particles easily attach (soil, etc. from the ground surface down to the depth of actual handling of soil, etc.; the depth should vary depending on the excavation depths in the actual decontamination works).

#### 4 Analysis methods

Either method below should be used for analysis.

(1) The total gamma ray measurement or gamma spectrum analysis, as specified in Article 9, Paragraph 1-2 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 dose rate on the sample surface and the sum of the concentrations

of Cs-134 and Cs-137 is known. (See Attachment 6-1 for details.)

- (i) Place the sample in a container and measure the weight.
  - (ii) Measure the maximum dose rate on the surface of the container.
  - (iii) Use the measured weight and the dose rate to calculate the sum of the concentrations of Cs-134 and Cs-137 in the sample.
- (b) It is difficult to measure radioactivity concentrations equal to 300,000Bq/kg or more with the simplified method even when using the V5-type container because the upper measurement limit of the typical NaI scintillation counter is as low as 30 $\mu$ Sv/h. Therefore, when the pointer on the scintillation counter goes past 30 $\mu$ Sv/h, the relevant regulations should be applied under the assumption that the concentration of the measured object exceeds 500,000Bq/kg, or an analysis should be carried out using the method of (1) above.
- (c) When measuring specimens for which radioactivity concentration is expected to be around 10,000Bq/kg, the surface dose rate should be measured while placing a sandbag at the area with low ambient dose rate because the measured surface dose rate could be lower than the ambient dose rate in the area.
- (3) Simplified measurement based on the relationship between ambient dose rate and radioactivity concentration
- (a) In the area where the average ambient dose rate is equal to 2.5 $\mu$ Sv/h or less, the radioactivity concentration may be calculated using the following method if the correlation between the ambient dose rate at a height of 1 m and the sum of the concentrations of Cs-134 and Cs-137 in the soil (the average from the ground surface to the depth of 15 cm) is known. (See Attachments 6-2 and 6-3 for details.)
- It should be noted that the simplified method shall not be applied to the works to handle soil near the ground surface of unplowed farmlands only or to handle fallen leaf layers or soil near the ground surface only, because data have indicated that approximately 50% of radioactive materials (for unplowed farmlands) or 60% of radioactive materials (for school yards) are accumulated in the zone from the ground surface to 1 cm in depth, and that radioactivity in the forest is mainly accumulated in fallen leaves.
- (b) For the contaminated soil in the living environment (areas around buildings, structures and roads), the simplified measurement described in (2) should be applied to soil etc. to be actually handled in the works, because applying the estimation result uniformly is not practical due to variation in the properties of buildings, structures, roads, rivers, and soils, etc.
- (c) Measurement methods
- (i) Agricultural soils
    - Measure average ambient dose rate at 1m in height from the ground surface (according to Attachment 5)
    - Select the estimation equation and conversion factor depending on the type of farmland and type of soil.
    - Use the estimation equation to estimate the sum of the concentrations of Cs-134 and Cs-137 in the soil, etc.

(ii) Fallen leaf layer in a forest

- Measure average ambient dose rate at 1m in height from the ground surface (according to Attachment 5)
- Use the estimation equation to estimate the sum of the concentrations of Cs-134 and Cs-137 in the soil, etc.



Attachment 6-1. Simplified measurement procedures for radioactivity concentration

1 Type of usable containers

- (1) Round V-series containers (plastic containers of 128mmφ x 56mmH. Hereinafter referred to as “the V5 container”.)
- (2) Sandbags
- (3) Flexible containers
- (4) 200L (liter) drum cans
- (5) 2L (liter) polyethylene bottles

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

- 1) Measure the radiation dose rate on the surfaces of containers containing accident-derived waste, and define the largest value as A (μSv/h).
- 2) Determine the radioactivity B (Bq) of the containers containing accident-derived waste by putting the factor X depending on the measurement date and the measured radiation dose rate A (μSv/h) into the following formula. Table 1 lists the values of the factor X by the measurement date and container type.

$$\boxed{A} \times \boxed{\text{Factor X}} = B$$

- 3) Measure the weight of the containers containing accident-derived waste. Set this as C (kg).
- 4) To determine the radioactivity concentration D (Bq) of the containers containing accident-derived waste, substitute the radioactivity of the containers containing accident-derived waste for B (Bq) and the weight for C (kg) in the following formula.

$$\boxed{B} \div \boxed{C} = D$$

Thus, it can be determined whether the radioactivity concentration D of the containers containing accident-derived waste is below 10,000Bq/kg, 500,000Bq/kg or 2,000,000Bq/kg.

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

Measurement date	Values of the factor X				
	V5 containers	Sandbag	Flexible containers	200L drum cans	2L polyethylene bottles
Until January 2018	4.4E+04	9.9E+05	1.3E+07	3.5E+06	1.3E+05
Until April 2018	4.4E+04	1.0E+06	1.3E+07	3.5E+06	1.3E+05
Until July 2018	4.5E+04	1.0E+06	1.3E+07	3.5E+06	1.3E+05
Until October 2018	4.5E+04	1.0E+06	1.4E+07	3.5E+06	1.3E+05
Until January 2019	4.5E+04	1.0E+06	1.4E+07	3.6E+06	1.3E+05
Until April 2019	4.6E+04	1.0E+06	1.4E+07	3.6E+06	1.3E+05
Until July 2019	4.6E+04	1.0E+06	1.4E+07	3.6E+06	1.3E+05
Until October 2019	4.6E+04	1.0E+06	1.4E+07	3.7E+06	1.3E+05
Until January 2020	4.7E+04	1.1E+06	1.4E+07	3.7E+06	1.3E+05
Until April 2020	4.7E+04	1.1E+06	1.4E+07	3.7E+06	1.4E+05
Until July 2020	4.7E+04	1.1E+06	1.4E+07	3.7E+06	1.4E+05
Until October 2020	4.7E+04	1.1E+06	1.4E+07	3.7E+06	1.4E+05
Until January 2021	4.8E+04	1.1E+06	1.4E+07	3.8E+06	1.4E+05
Until April 2021	4.8E+04	1.1E+06	1.4E+07	3.8E+06	1.4E+05
Until July 2021	4.8E+04	1.1E+06	1.5E+07	3.8E+06	1.4E+05
Until October 2021	4.8E+04	1.1E+06	1.5E+07	3.8E+06	1.4E+05
Until January 2022	4.8E+04	1.1E+06	1.5E+07	3.8E+06	1.4E+05

\* Prepared by the Office of Workers Health Planning for Ionizing Radiation, Industrial Health Division, Industrial Safety and Health Department, Labour Standards Bureau, Ministry of Health, Labour and Welfare with the cooperation of the Japan Atomic Energy Agency

Attachment 6-2. Simplified procedures for measurement of radioactivity concentration of agricultural soil

1 Method to determine that the radioactivity (total radioactivity of Cs-134 and Cs-137) in agricultural soil is lower than 10,000Bq/kg based on the average ambient dose rate at the height of 1m from the ground surface

- 1) Measure the average ambient dose rate  $\bar{A}$  ( $\mu\text{Sv/h}$ ) at the workplace (farmland) before starting the work (See Attachment 5 for the measurement method)
- 2) Select the estimation formula depending on the type of farmland and type of soil\*<sup>1</sup> as summarized in Table 1.
- 3) Estimate the radioactivity concentration of Cs in the agricultural soil (15cm in depth), by substituting the measurement  $\bar{A}$  ( $\mu\text{Sv/h}$ ) into the formula selected in Step 2).

$$\text{Ambient dose rate } \bar{A} (\mu\text{Sv/h}) \times \text{Factor } \bar{X} - \text{Factor } \bar{Y}$$

$$= \text{Radioactivity concentration (total of Cs-134 and Cs-137) (Bq/kg)}$$

(Example)

Radioactivity concentration of Cs in Andosols for a “rice paddy in other areas” when the average ambient dose rate is 0.2 $\mu\text{Sv/h}$  (Estimation formula: C)\*<sup>2</sup>

$$0.2 \times 7,800 - 321 = 1,239\text{Bq/kg (Estimated)}$$

Table 1: Selection of estimation formula

Zone	Type of farmland	Type of soil	Formula	Factor X	Factor Y
Evacuation area	Non-decontaminated farmland		A	5,370	0
	Decontaminated farmland * <sup>4</sup>		B	4,080	0
Other areas	Rice paddy	Andosol	C	7,800	321
		Non-Andosol	D	6,410	186
	Agricultural field	Andosol	E	5,830	184
		Non-Andosol	F	5,720	183
	Orchard • Pasture		G	3,490	0

\*1 Whether or not the soil of the farmland is an Andosol type can be checked by using the soil distribution map in the “Japan Soil Inventory” on the webpage of the Institute for Agro-Environmental Science, National Agriculture and Food Research Organization [URL:

<http://soil-inventory.dc.affrc.go.jp/>

- \*2 The conversion factors will change due to radioactivity decay with time. The estimation formula will be revised before the change becomes too large to be negligible.
- \*3 Prepared by the Institute for Agro-Environmental Science, National Agriculture and Food Research Organization (January 2018)
- \*4 Farmlands which have been deeply plowed or whose topsoil has been stripped.

Table 2: Correspondence between radioactive Cs concentration and averaged ambient dose rates in non-decontaminated farmland in the emergency evacuation areas

Ambient Dose Rate ( $\mu\text{Sv/h}$ )	Cs Concentration (Bq/kg)	Ambient Dose Rate ( $\mu\text{Sv/h}$ )	Cs Concentration (Bq/kg)	Ambient Dose Rate ( $\mu\text{Sv/h}$ )	Cs Concentration (Bq/kg)
0.1	537	1.1	5,907	2.1	11,277
0.2	1,074	1.2	6,444	2.2	11,814
0.3	1,611	1.3	6,981	2.3	12,351
0.4	2,148	1.4	7,518	2.4	12,888
0.5	2,685	1.5	8,055	2.5	13,425
0.6	3,222	1.6	8,592	2.6	13,962
0.7	3,759	1.7	9,129	2.7	14,499
0.8	4,296	1.8	9,666	2.8	15,036
0.9	4,833	1.9	10,203	2.9	15,573
1.0	5,370	2.0	10,740	3.0	16,110

- \* Prepared by the Institute for Agro-Environmental Science, National Agriculture and Food Research Organization (January 2018)

Attachment 6-3. Simplified measurement method for radioactivity concentration of forest soil, etc.

1 Method to determine that the radioactivity (total of Cs-134 and Cs-137) in the fallen leaf layer and soil in forest (hereafter referred to as “forest soil, etc.”) is lower than 10,000Bq/kg based on the average ambient dose rate at the height of 1 m from the ground surface

1) Measure the average ambient dose rate  $\bar{A}$  ( $\mu\text{Sv/h}$ ) at the workplace (forest) before starting the work (See Attachment 5 for the measurement method)

2) To estimate the radioactivity concentration of Cs in the forest soil, etc. (15 cm in depth), substitute the measurement  $\bar{A}$  ( $\mu\text{Sv/h}$ ) into the formula.\*

$$(\bar{A} (\mu\text{Sv/h}) \times 10,580) - 590 = \text{Radioactivity concentration (total of Cs-134 and Cs-137) (Bq/kg)}$$

(\*1, 2)

Example

The radioactivity concentration of Cs when the average ambient dose rate is 1.0 $\mu\text{Sv/h}$

$$(1.0 (\mu\text{Sv/h}) \times 10,580) - 590 = 9,990\text{Bq/kg (Estimated)}$$

Lookup table for radioactive Cs concentrations in forest soil as a function of ambient dose rates\*3

Average ambient dose rate ( $\mu\text{Sv/h}$ )	Cs concentration (Bq/kg)	Average ambient dose rate ( $\mu\text{Sv/h}$ )	Cs concentration (Bq / kg)	Average ambient dose rate ( $\mu\text{Sv/h}$ )	Cs concentration (Bq/kg)
0.1	468	1.1	11,048	2.1	21,628
0.2	1,526	1.2	12,106	2.2	22,686
0.3	2,584	1.3	13,164	2.3	23,744
0.4	3,642	1.4	14,222	2.4	24,802
0.5	4,700	1.5	15,280	2.5	25,860
0.6	5,758	1.6	16,338		
0.7	6,816	1.7	17,396		
0.8	7,874	1.8	18,454		
0.9	8,932	1.9	19,512		
1.0	9,990	2.0	20,570		

\*1 Source: Dr. Shinji Kaneko, “Aging of Radioactive Cesium Amount and Air Dose Rate in Forest”, Abstracts of the Annual Meeting, Japanese Society of Soil Science and Plant Nutrition No. 63 September 2017, P.15

\*2 The conversion factors will vary due to radioactivity decay over time. The estimation formula will be revised before the variation becomes too large to ignore.

\*3 Prepared by Forestry Labor Office, Forestry Management Improvement Division, Forest

Policy Planning Department, Forestry Agency with the cooperation of Forest and Forest Products Research Institute, Forest Research and Management Organization (January 2018)

Attachment 7. Special education for operation leaders

Education for operation leaders who direct the decontamination works (for the works for handling designated contaminated soil and wastes, they are limited to those in the workplaces where the average ambient dose rate exceeds 2.5 $\mu$ Sv/h.) should be provided by lectures according to the table below, which shows general subject areas in the left column with specific topics in the middle column. Hours for each subject should be more than that in the right column.

Subject areas	Topics	Minimum duration
How to determine work procedures and arrange the workers engaged in decontamination works	1) Structure and handling of radiation detectors 2) Methods for preliminary survey 3) Establishment of work plans 4) Determination of work procedures	2.5 hours
How to direct the workers engaged in decontamination works	1) Methods for directing inspections, including before work, etc. and education 2) Methods of instruction during works 3) Methods to instruct workers in appropriate usage of protective equipment	2 hours
How to take actions in case of abnormal events	1) Emergency actions in case of occupational hazards 2) Methods of transport to the hospital, etc.	1 hour

Attachment 8. Special education for workers

Special education for the workers engaged in decontamination works should be provided by lectures and practical training.

The theoretical education by lectures should follow the table below showing general subject areas in the left column with specific topics in the middle column. Hours for each subject should be more than that in the right column.

Subject areas	Topics	Minimum duration
Knowledge about effects of ionizing radiation on living bodies and exposure dose control methods	For the workers engaged in the decontamination works (except for those who handle designated contaminated soil and wastes., only at the workplace where the average ambient dose rate is equal to 2.5 $\mu$ Sv/h or less): 1) Types and nature of ionizing radiation 2) Effects of ionizing radiation on cells, tissues, organs and the whole body 3) Exposure dose limit and methods of dose measurements 4) Method for confirming and recording the result of dose measurements	1 hour
	For the workers engaged in works for handling designated contaminated soil and wastes., only at the workplace where the average ambient dose rate is equal to 2.5 $\mu$ Sv/h or less: 1) Types and nature of ionizing radiation 2) Effects of ionizing radiation on cells, tissues, organs and the whole body 3) Exposure dose limit	1 hour
Knowledge about the methods for decontamination related works	For the workers engaged in decontamination, etc.: 1) Methods and procedures of works for decontamination, etc. 2) Methods for radiation measurement 3) Methods for monitoring of dose equivalent rate from external radiation 4) Methods for preventing spread of contamination 5) Methods for inspection of contamination on the body surface, etc. and for decontamination 6) Functions and use of protective equipment 7) Emergency actions in case of abnormal events	1 hour
	For the workers engaged in collecting, transporting or storing removed soil (hereinafter as “work for collecting removed soil, etc.”): 1) Methods and procedures of works for collecting removed soil, etc. 2) Methods for radiation measurement 3) Methods for monitoring of dose equivalent rate from external radiation 4) Methods for preventing spread of contamination 5) Methods for inspection of contamination on the	1 hour



	body surface, etc. and for decontamination 6) Functions and use of protective equipment 7) Emergency actions in case of abnormal events	
	For the workers engaged in collecting, transporting or storing contaminated waste (hereinafter as “work for collecting contaminated waste, etc.”): 1) Methods and procedures of works for collecting contaminated waste, etc. 2) Methods for radiation measurement 3) Methods for monitoring of dose equivalent rate from external radiation 4) Methods for preventing spread of contamination 5) Methods for inspection of contamination on the body surface, etc. and for decontamination 6) Functions and use of protective equipment 7) Emergency actions in case of abnormal events	1 hour
	For the workers engaged in the works for handling designated contaminated soil and wastes., at the workplace where average ambient dose rate is greater than 2.5μSv/h (hereinafter as “the works for handling designated contaminated soil and wastes.”): 1) Methods and procedures of works for handling designated contaminated soil and wastes. 2) Methods for radiation measurement 3) Methods for monitoring of dose equivalent rate from external radiation 4) Methods for preventing spread of contamination 5) Methods for inspection of contamination the on the body surface, etc. and for decontamination 6) Functions and use of protective equipment 7) Emergency actions in case of abnormal events	1 hour
	For the workers engaged in the works for handling designated contaminated soil and wastes., only at the workplace where average ambient dose rate is equal to 2.5 μSv/h or less): 1) Methods and procedures of work handling designated contaminated soil and wastes. 2) Methods for radiation measurement 3) Methods for preventing spread of contamination 4) Methods for inspection of contamination on the body surface, etc. and for decontamination 5) Functions and use of protective equipment 6) Emergency actions in case of abnormal events	1 hour
Knowledge about structure and handling of the machinery, etc. used for decontamination related works (limited to the name and usage of the machinery in the case for workers engaged in handling designated	For the workers engaged in decontaminating soil, etc.: The structure and handling of the machinery, etc. used for decontamination work	1 hour
	For the workers engaged in collecting removed soil, etc.: The structure and handling of the machinery, etc. used for the work collecting removed soil, etc.	1 hour
	For the workers engaged in collecting waste, etc.: The structure and handling of the machinery, etc. used for the work collecting waste, etc.	1 hour

contaminated soil and wastes.,)	For the workers engaged in handling designated contaminated soil and wastes. The name and use of machinery for the works for handling designated contaminated soil and wastes.	30 minutes
Relevant laws and regulations	Relevant provisions stipulated in the Industrial Safety and Health Act, the Order for Enforcement of the Industrial Safety and Health Act, the Ordinance on Industrial Safety and Health, and the Ionizing Radiation Ordinance for Decontamination	1 hour

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

Subject areas	Topics	Minimum duration
How to conduct decontamination related works and how to handle the machinery, etc. (limited to the practice on how to conduct decontamination related works in the case for the workers engaged in handling designated contaminated soil and wastes)	For the workers engaged in decontamination, etc.: 1) ractice of work for decontamination, etc. 2) Handling of radiation detectors 3) Monitoring of dose equivalent rate from external radiation 4) Measures for preventing spread of contamination 5) Inspection of contamination on the body surface, etc. and decontamination 6) Handling and use of protective equipment 7) Handling of the machinery used for decontaminating soil, etc.	1.5 hours
	For the workers engaged in collecting removed soil etc. : 1) Practice of work for collecting removed soil, etc. 2) Handling of radiation detectors 3) Monitoring of dose equivalent rate from external radiation 4) Measures for preventing spread of contamination 5) Inspection of contamination on the body surface, etc. and decontamination 6) Handling and use of protective equipment 7) Handling of the machinery used for collecting removed soil, etc.	1.5 hours
	For the workers engaged in collecting contaminated waste, etc.: 1) Practice of work for collecting contaminated waste, etc. 2) Handling of radiation detectors 3) Monitoring of dose equivalent rate from external radiation 4) Measures for preventing spread of contamination 5) Inspection of contamination on the body surface, etc. and decontamination 6) Handling and use of protective equipment 7) Handling of the machinery used for collecting contaminated waste, etc.	1.5 hours

	<p>For the workers engaged in the works for handling designated contaminated soil and wastes, at the workplace where average ambient dose rate is greater than 2.5<math>\mu</math>Sv/h:</p> <ol style="list-style-type: none"> <li>1) Practice of the works for handling designated contaminated soil and wastes.</li> <li>2) Handling of radiation detectors</li> <li>3) Monitoring of dose equivalent rate from external radiation</li> <li>4) Measures for preventing spread of contamination</li> <li>5) Inspection of contamination on the body surface, etc. and decontamination</li> <li>6) Handling and use of protective equipment</li> </ol>	1 hour
	<p>For the workers engaged in the works for handling designated contaminated soil and wastes, only at the workplace where average ambient dose rate is equal to 2.5<math>\mu</math>Sv/h or less:</p> <ol style="list-style-type: none"> <li>1) Practice of the works for handling designated contaminated soil and wastes</li> <li>2) Handling of radiation detectors</li> <li>3) Measures for preventing spread of contamination</li> <li>4) Inspection of contamination on the body surface, etc. and decontamination</li> <li>5) Handling and use of protective equipment</li> </ol>	1 hour