

Overview of the Expert Meeting's Report on the Prevention of Radiation Hazards for Workers Engaged in the Disposal of Decontamination Waste

1. Scope

This document shall be for the operator engaged in the operation involving disposal of objects contaminated with accident-derived radioactive material as stated below (hereinafter the operator, operation, and objects are referred to as the "disposal operator", "accident-derived waste disposal" and "accident-derived waste", respectively).

- a. Soil generated from decontamination (including the actions necessary to remove soil contaminated with accident-derived radioactive material, soil attached to contaminated plants and structures, fallen leaves and branches, and sludge accumulated in waterways, to prevent spread of the contamination, and to reduce impact of the contamination). (This is soil having a radioactivity concentration of cesium-134 and cesium-137 exceeding 10,000 Bq/kg; hereinafter referred to as "removed soil".)
- b. Waste contaminated with accident-derived radioactive material. (This is waste having a radioactivity concentration of cesium-134 and cesium-137 exceeding 10,000 Bq/kg.)

(Note) "Disposal" includes final disposal (landfill), interim storage, interim treatment (sorting, crushing, compressing, concentrating, and incinerating, etc.), and maintenance and inspection of the relevant facilities and/or equipment.

2. Methods for setting radiation controlled areas and exposure dose control, and dose limits at the facilities

- (1) Relevant provisions in the current Ordinance on Prevention of Ionizing Radiation Hazards (hereinafter referred to as "the Ionizing Radiation Ordinance") shall be applied to clarify the radiation controlled areas, dose measurement, radiation exposure dose limits, and recording of dose measurement results.
- (2) Relevant provisions in the current Ionizing Radiation Ordinance shall be applied to dose limits, surface contamination limits, and measurement of working environments at facilities.

3. Requirements for equipment used for preventing spread of contamination

- (1) The disposal operator shall clearly indicate the border of the disposal site by posting signage and constructing fences and other structures.
- (2) Accident-derived waste handling facilities
 - a. The disposal operator shall build a facility designated for the work handling accident-derived waste when handling unsealed waste, and shall conduct the work within the facility.
 - b. The ceilings, walls, floors, and other parts that may possibly be contaminated which are located inside the accident-derived waste handling facility shall be made of materials with low gas or liquid permeabilities and good corrosion resistance, and their surface finishes shall allow for easy

decontamination.

- c. In addition to b, actions shall be taken to prevent dust or liquid generated after the handling process from leaking outside the accident-derived waste handling site, according to the characteristics of the accident-derived waste being handled.
- d. Actions shall be taken to prevent spreading contamination at the entrance and exit of accident-derived waste handling facility by setting double-entry doors, etc.
- e. The disposal operator shall post signage indicating the accident-derived waste handling facility at the entrance and exit of the facility to prohibit entry by all except those allowed access.

(3) Crushing equipment

When using machines for crushing, classifying, compressing, and enriching handling accident-derived waste (hereinafter referred to as "crushing equipment"), the disposal operator shall ensure the following.

- a. Accident-derived waste that may generate liquid contaminated with radioactive material shall be handled in crushing equipment having a structure design that has no possibility for leakage of liquid and is made of corrosion-resistant material with low liquid permeability.
- b. Accident-derived waste that may generate dust or gas contaminated with radioactive material shall be handled in crushing equipment having a structure design that has no possibility for dust dispersion and gas leakage.
- c. Signage regarding the crushing equipment shall be posted in an easily visible place outside the equipment.

(4) Incinerators

The disposal operator shall incinerate accident-derived waste by using an incinerator with a structure design that has no possibility for gas leakage and ash dispersion and shall post signage regarding the incinerator in an easily visible place outside it.

(5) Landfill facilities

- a. The disposal operator shall bury accident-derived waste at a landfill facility which is separated from the outside surroundings and has keys and other equipment or apparatuses to shut the doors, lids and other parts connected to the outside.
- b. The disposal operator shall post signage outside the facility and set up fences and the like to prohibit entry by all except those allowed access.

(6) Storage facilities

The disposal operator shall store accident-derived waste at a storage facility which is separated from the outside surroundings and provide keys and other equipment to shut the doors, lids and other parts connected to the outside, and post signage indicating the storage facility in an easily visible place.

(7) Facilities for gas or liquid discharge treatment

When transferring, storing, or treating waste gas or liquid from the accident-derived waste handling facility, the disposal operator shall use a facility having a structure design that has no possibility of leakage of waste

gas or liquid and is made of corrosion-resistant material with low permeability.

(8) Belt conveyors

When transporting unsealed accident-derived waste, the disposal operator shall use belt conveyors having a structure design that has no possibility of dust dispersion or leakage of gas or liquid and is made of corrosion-resistant material with low permeability; this may be done by using covers, etc. according to the characteristics of the accident-derived waste transported.

(9) Actions for maintenance

- a. Before opening access doors for maintenance or inspection of equipment or facilities, the disposal operator shall take measures to prevent spread of contamination by covering the access openings with water shielding sheets, etc.
- b. The disposal operator shall require workers wear the protective equipment specified in Section 4 during maintenance and inspection and shall inspect the contamination levels around the opening after the task, and decontaminate it to the level below one-tenth of the surface contamination limit (4 Bq/cm^2).

4. Measures for preventing contamination

(1) Containers

The disposal operator shall use containers for temporary keeping, storing, transporting, or burying of accident-derived waste. It should be noted however that this shall not be applied when effective measures are taken for external radiation shielding or prevention of the spread of contamination from waste which is extremely difficult to put in containers.

(2) Contamination inspection

The disposal operator shall make a contamination inspection area available at the exit of the accident-derived waste handling facility and other facilities that may be contaminated in excess of one-tenth of the surface contamination limit (4 Bq/cm^2), check the contamination levels when workers exit or take items from the facility, and prohibit them from exiting or taking items from the facility until the contamination levels are reduced to one-tenth of the surface contamination limit (4 Bq/cm^2) or less.

It should be noted however that this shall not be applied when such items are transported to the facilities for removing their contamination, or for disposing of accident-derived waste after measures were taken to prevent the spread of contamination by putting them in a container, etc.

(3) Protective equipment

a. Respiratory protective equipment

The disposal operator shall prepare the following respiratory protective equipment (i. e. respirators) to be used by workers engaged in the activities that may cause them to inhale air exceeding the concentration limit of airborne radioactive materials (approx. 50 mSv per year).

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

b. Protective clothing

The disposal operator shall provide the following effective protective clothing, gloves and shoes to be used by workers engaged in the activities that may exceed one-tenth of the surface contamination limit (4 Bq/cm²).

	Radioactivity Concentration Higher than 2,000,000 Bq/kg	Radioactivity Concentration from 500,000 Bq/kg to 2,000,000 Bq/kg	Radioactivity Concentration 500,000 Bq/kg or less
Dust concentration higher than 10 mg/m ³	Double air-tight chemical protective suit to be worn over a long sleeve shirt, double rubber gloves worn over cotton gloves and rubber boots	Air-tight chemical protective suit to be worn over a long sleeve shirt, rubber gloves worn over cotton gloves and rubber boots	A long sleeve shirt, cotton gloves, and rubber boots
Dust concentration equal to 10mg/m ³ or less	Air-tight chemical protective suit to be worn over a long sleeve shirt, rubber gloves worn over cotton gloves and rubber boots	A long sleeve shirt, rubber gloves to be worn over cotton gloves, and rubber boots	A long sleeve shirt, cotton gloves, and rubber boots

c. When it is found that the respiratory protective equipment and protective clothing are contaminated in excess of the contamination limit, the disposal operator shall not provide workers such equipment until the contamination is washed off to the contamination level of the limit or less.

(4) The disposal operator shall prohibit workers from smoking, drinking and eating in a facility for handling accident-derived waste and any other workplaces where they may intake radioactive materials by inhalation or ingestion.

5. Work management

The disposal operator shall develop rules concerning operational methods and procedures and adjustments of safety and alarm equipment, follow these rules in disposing of accident-derived waste, and disseminate the rules to the involved workers.

6. Education for workers

The disposal operator shall provide workers with special education on the following subjects before assigning any activities for accident-derived waste disposal.

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

7. Actions for health care

- (1) The disposal operator shall provide workers with medical examinations at the time of employment or being transferred to the activities of accident-derived waste disposal and thereafter once every 6 months on a regular basis. (A worker shall be able to omit the test items except the exposure history examination if his or her exposure dose is within the annual exposure dose of 5 mSv.)
- (2) The disposal operator shall prepare medical examination cards based on the medical examination results and keep them for 30 years (the records can be transferred to a designated organization after being kept for 5 years).

8. Safety and health management system

- (1) The facility management operator (facility owner) shall establish councils for involved operators, and manage equipment and other items used for maintenance and repair.
- (2) The facility operators (e.g., operators commissioned to conduct all or part of the operation management in the facility) and the facility maintenance operators (e.g., operators commissioned to conduct all or part of the maintenance management in the facility) shall implement the following tasks if they are primary contractors.
- (3) Establishment of the safety and health management system by primary contractors
The primary contractor involved in accident-derived waste disposal shall assign a general safety and health manager among the individuals who supervise and manage the activities of accident-derived waste disposal to perform the following tasks (a) through (c) in order to ensure that the safety and health management is implemented in an appropriate manner.
 - a. The relevant subcontractors shall assign the responsible person for safety and health management.
 - b. The safety and health coordinating meeting of all the relevant subcontractors shall be held once every month on a regular basis.

c. The relevant subcontractors shall be guided or supported as necessary to ensure that the developed work rules have appropriate contents.

(4) Consolidated management of exposure status by primary contractors

The primary contractors engaged in accident-derived waste disposal shall assign a radiation administrator to consolidate the management of radiation exposure doses to their workers including the workers for the relevant subcontractors.

(5) Safety and health management system by disposal operators

The disposal operator shall assign a health manager or a safety and health promoter according to the scale of the site to manage the technical aspects of actions for health care and related matters.

9. Exemptions in the special decontamination areas

(1) Exemptions in constructing disposal sites in the special decontamination areas

- a. In the case of spillage of accident-derived waste outside a disposal site established in a special decontamination area, where the surface contamination has already exceeded 4 Bq/cm^2 due to contamination by accident-derived radioactive material, it shall be sufficient for the disposal operator to remove the contamination to the surface contamination density in average around the disposal site (background), upon taking actions to prevent spread of the contamination; and the contaminated area shall be clearly indicated, regardless of the surface contamination limit of 4 Bq/cm^2 specified in the Ionizing Radiation Ordinance.
- b. With respect to the contamination inspection and contamination limit in a disposal site established in a special decontamination area, the provisions in Articles 14 and 15 of the Ionizing Radiation Ordinance for Decontamination shall be applied with modifications, regardless of Section 4 (2), it shall be sufficient to locate one contamination inspection area in or around the disposal site in a special decontamination area, where 40 Bq/cm^2 shall be defined as the surface contamination limit.

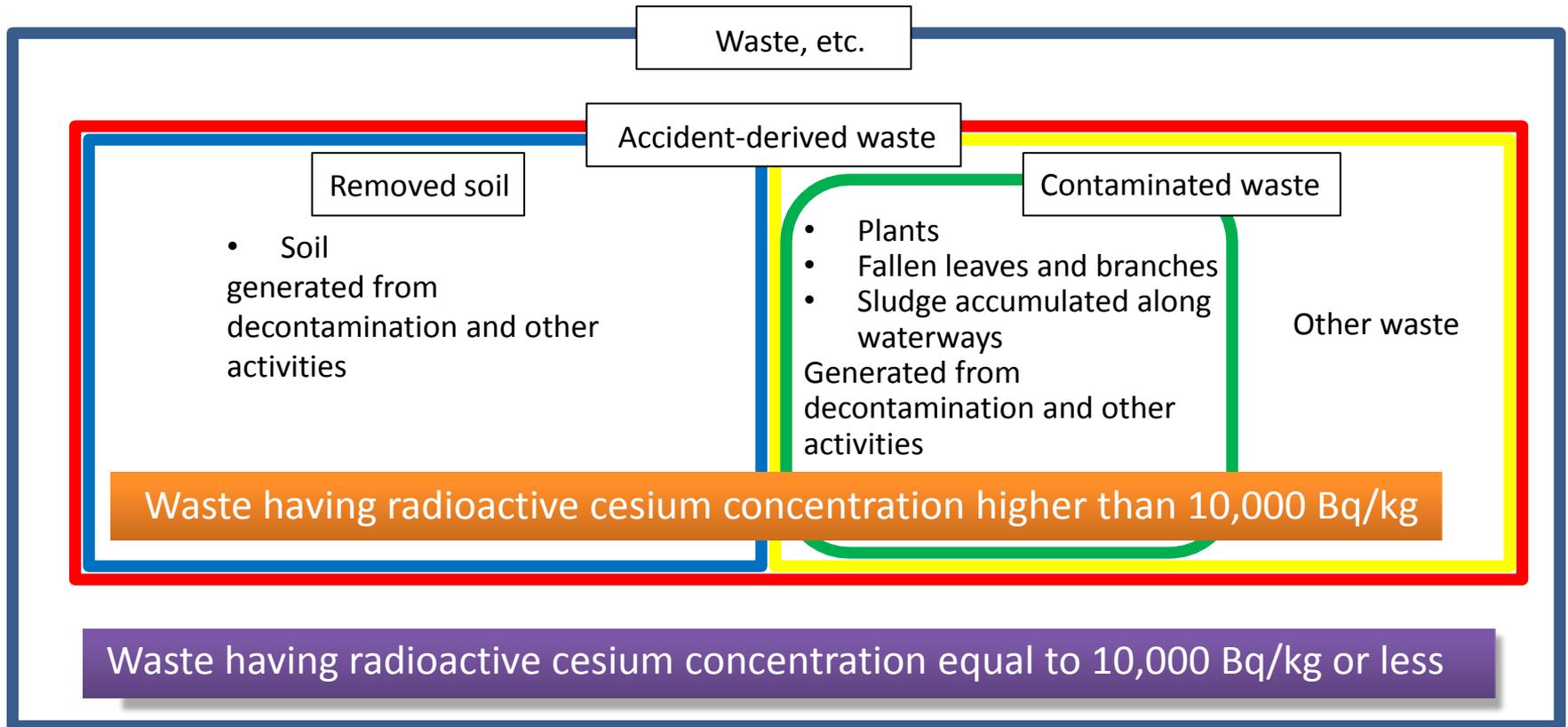
(2) Exemptions in handling removed soil at landfill facilities constructed in the special decontamination areas

If the disposal operator handles removed soil at a landfill facility constructed in a special decontamination area and if the case conforms to the following statements, it shall be acceptable not to use containers and to omit actions described in items b through d in Section 3 (2), regardless of the regulations specified in Section 4 (1).

- a. Removed soil is unlikely to contaminate the workers because it is handled by using remotely operated machines.
- b. Measures have been taken to control dust dispersion by maintaining removed soil in a wet state, etc.
- c. Measures have been taken to control dust dispersion by isolating the boundary of the landfill facility from the work area, etc.
- d. Contamination surface density at the boundary of the landfill facility is inspected once every month, and measures are taken to remove any contamination if the removed soil-derived contamination is observed.

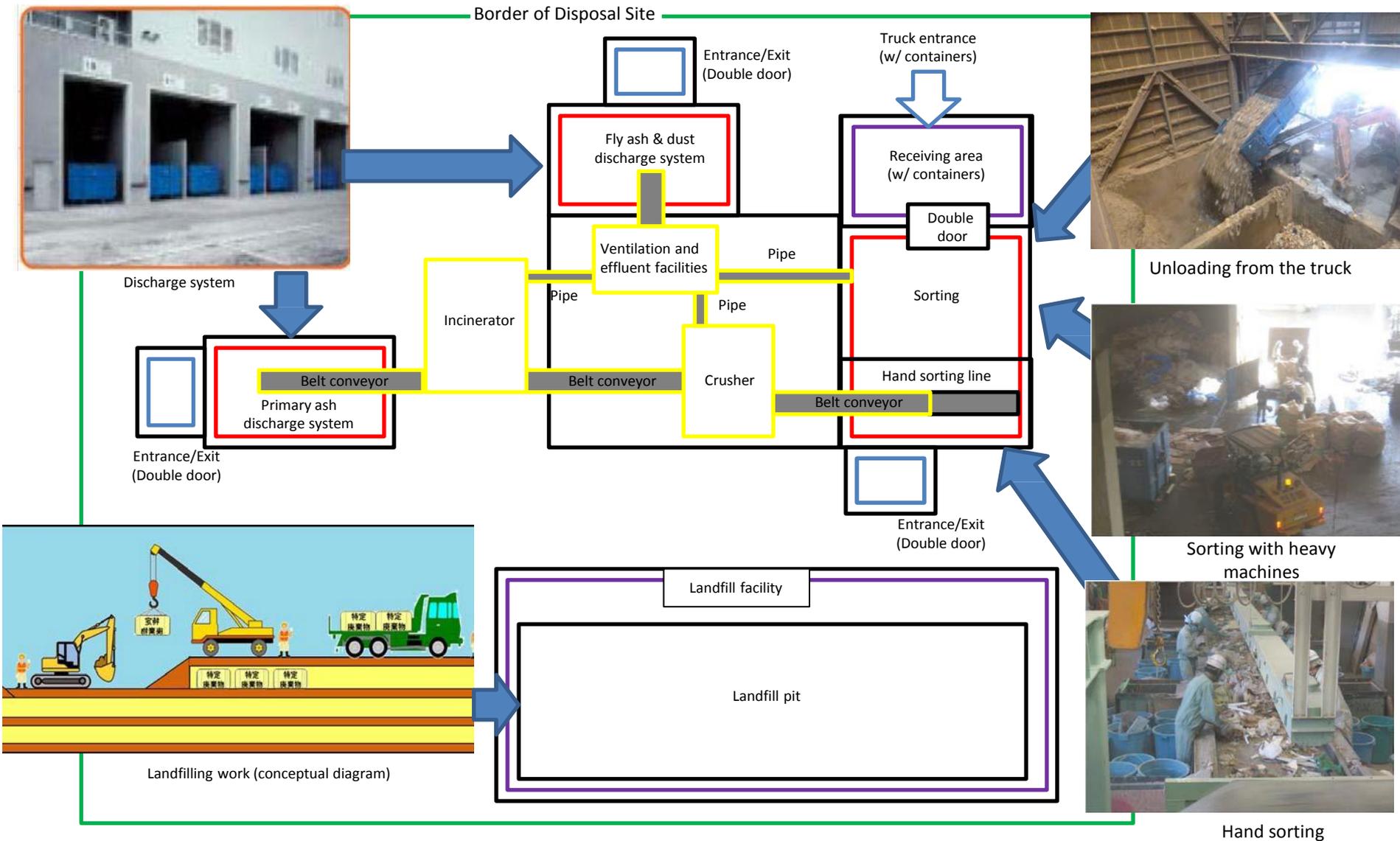
Definition of Accident-derived Waste

Removed soil	Soil generated from activities such as decontamination (concentration of radioactive cesium > 10,000 Bq/kg)
Contaminated waste	Waste contaminated with accident-derived radioactive materials (concentration of radioactive cesium > 10,000 Bq/kg)
Accident-derived waste	Removed soil and contaminated waste



Overview of Disposal Facilities for Accident-derived Waste

Disposal facilities for accident-derived waste are constructed using structures with no possible leakage of exhaust air or liquid waste (facility requirement) and are controlled based on the limits on ambient dose rate and surface contamination (dose limits).



Activities to be addressed by laws and regulations

Activities to be reviewed

1. Activities for disposal of the “accident-derived waste” are as follows :

- (1) Soil generated from decontamination having radioactivity concentration in excess of 10,000 Bq/kg (**Removed soil**)
- (2) Waste contaminated with accident-derived radioactive materials (released by TEPCO’s Fukushima Daiichi Nuclear Power Plant) having radioactivity concentration in excess of 10,000 Bq/kg (**Contaminated wastes**)

2. “Disposal” comprises the following activities :

- (1) Final disposal (landfill) and interim storage
- (2) Interim treatment (sorting, crushing, compression, concentration, and incineration, etc.)
- (3) Maintenance and inspection of relevant facilities and equipment

Summary of new measures

Employers involved in the waste disposal and other related projects are required to conform the additional regulations described in (1) to (5)

(1) Requirements for the accident-derived waste disposal equipment

Applied facilities: waste handling facility, crushing system, incinerator, landfilling facility, storage facility, and effluent processing facility, etc.

Description: Facilities must have structures with no potential risk of leakage of contaminated gases or liquids and be equipped with double door at the entrance/exit.

(2) Measures to prevent spread of contamination

Use of respirators and protective clothing appropriate for the contamination level, contamination inspection after work, and use of containers, etc.

(3) Work management

Preparation and dissemination of manuals that specify operational methods and procedures, and safety system adjustment methods.

(4) Special education

Education for workers engaged in disposal work in advance regarding the effect of ionizing radiation on living organisms, and methods of dose control, operation and using machines.

(5) Exemptions in building disposal facilities in the special decontamination areas

The level of contamination in the soil should be considered before establishing the facilities. Depending on the condition of the soil, exceptions will be made regarding inspections and use of containers.

* Note that the current rules remain intact regarding setting controlled areas, measuring and recording exposure dose, exposure limit, and dose limit in the facilities.

Requirements for Facilities in the Disposal Site and Dose Limit

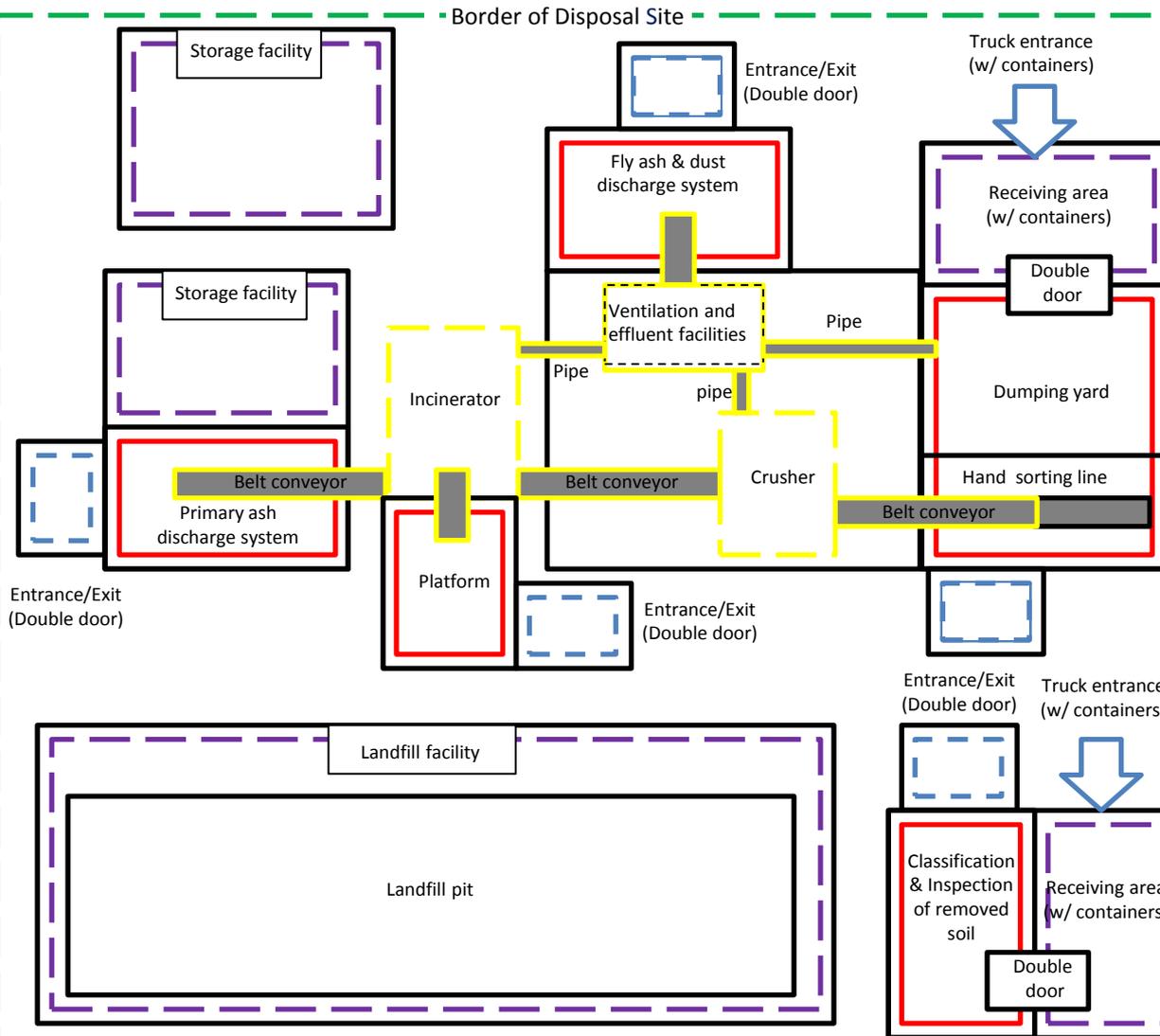
The disposal facilities for accident-derived waste are controlled by both the structures to prevent leakage of internal gases and liquids (requirements for facilities) and the ambient dose rate and surface contamination limit (dose limit).

Areas under the Ionizing Radiation Ordinance

- Facility requirements
 - Construct fences at borders
 - Clear indication of radiation controlled areas and measures for prohibiting entrance
 - $> 1.3 \text{ mSv}/3 \text{ months}$
 - $> 4 \text{ Bq}/\text{cm}^2$
 - Does limits (except in radiation controlled areas)
 - $\leq 4 \text{ Bq}/\text{cm}^2$
 - $\leq 1/10$ of airborne concentration limit (approx. $5 \text{ mSv}/\text{y}$) or less
 - Monitoring of work environment (controlled area)
- Ambient dose rate

Storage and landfilling facilities (using containers)

- Facility requirements
 - Isolation from outside
 - Posting signs
- Dose limit
 - $\leq 1 \text{ mSv}/\text{week}$



Facilities for handling accident-derived waste (handling unsealed wastes)

- Facility requirements
 - Minimum clearance gaps between ceilings, walls, and floors
 - Easy to decontaminate
 - Leakage proof structure and materials
 - Double door at entrance/exit
 - Post warning signs and enforce measures for prohibiting entrance
- Dose limits
 - $\leq 1 \text{ mSv}/\text{week}$ (\leq airborne concentration limit ($50 \text{ mSv}/\text{y}$))
 - $\leq 40 \text{ Bq}/\text{cm}^2$
- Monitoring of work environment
 - Airborne radioactivity concentrations
 - Surface contamination on ceilings, floors, walls, and facilities

Contamination inspection area

- Contamination limit $4 \text{ Bq}/\text{cm}^2$

Incinerator, effluent and ventilation facilities, crushing system, belt conveyors, etc. (workers can not enter during operation)

- Facility requirements
 - Leakage proof structure and materials
 - Posting signs

Requirements for Facilities in the Disposal Site and Dose Limit <Exemptions>

In the case that a disposal site is set up in the special decontamination areas, some exceptions will be made because soil in and around the site has already been contaminated by accident-derived radioactive material.

Areas under the Ionizing Radiation Ordinance

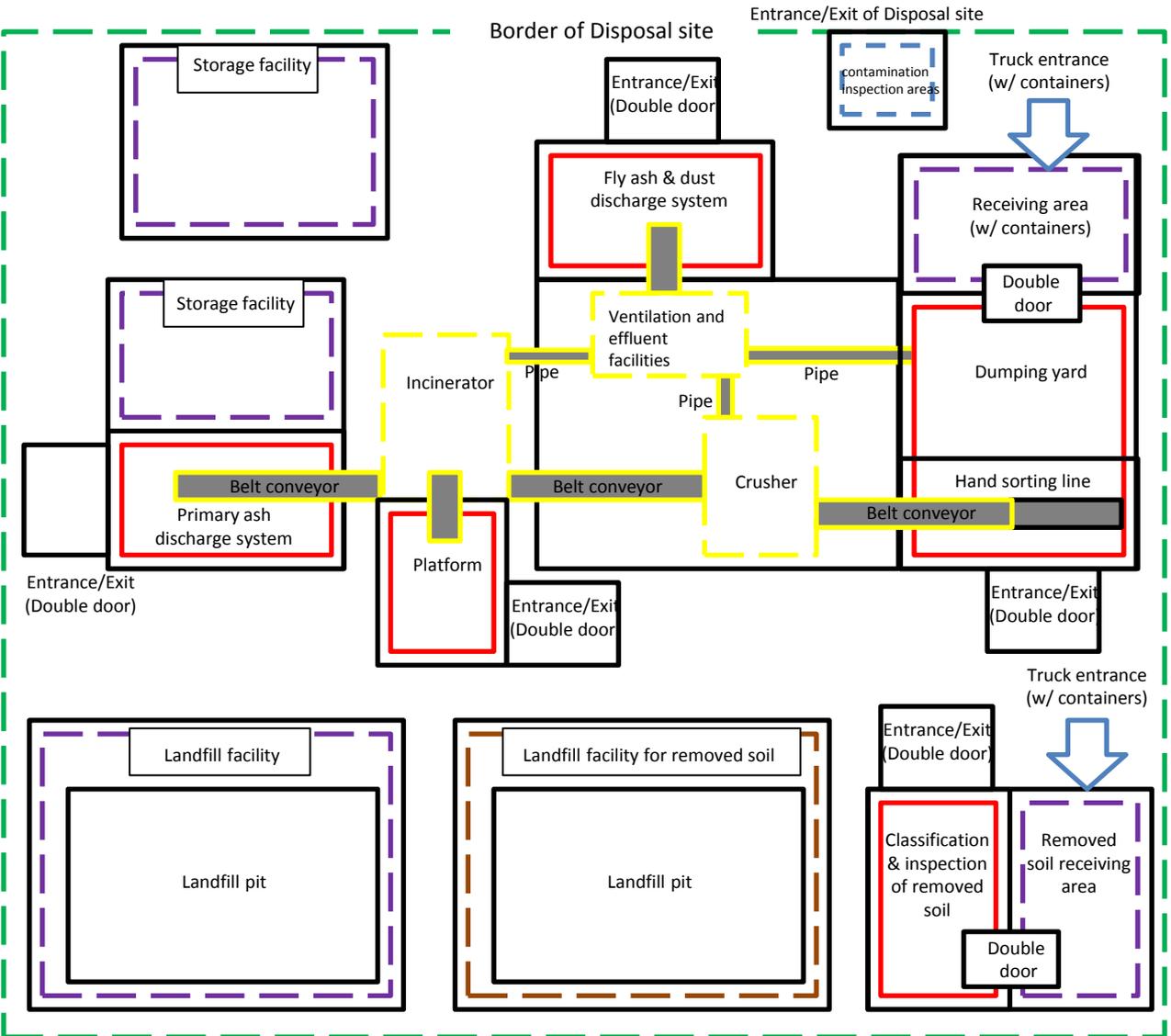
- Special case for the surface contamination limit when accident-derived waste is spilled (except in radiation controlled areas)
- Sufficient to decontaminate to the level that falls within the average surface contamination (background) around the disposal site.

Landfill facility (removed soil only)

- Special case in the use of containers

Use of containers will be exempted if all of the following measures are taken.

- Limited to landfill or storage of removed soil.
- Ensure no risk of contamination to workers by employing measures such as remote operation.
- Prevent propagation of contamination to the surroundings of the landfill facility by spraying water, and providing an isolation distance, etc.
- Inspect surface contamination at the border of the landfill facility more than once per month. Decontaminate, if necessary.



Contamination Inspection

Application mutatis mutandis of the Ionizing Radiation Ordinance for Decontamination

- Contamination inspection areas Can be consolidated and located near the border of the disposal site.
- Contamination limit 40 Bq/cm²

Accident-derived waste handling facilities (removed soil only)

Use of containers is exempted if the soil handling method meets the conditions for the exemption.