Development of technologies for the processing and disposal of radioactive waste

International Experts' Symposium on the Decommissioning of
TEPCO's Fukushima Daiichi Nuclear Power Plant Unit 1-4

March 14, 2012
Tokyo, Japan

Tokyo Electric Power Company, Inc.

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Outline

Feature of radioactive waste in Fukushima Daiichi NPP

- Highly contaminated debris by hydrogen explosions
- Secondary waste by treatment of contaminated water (zeolite waste, sludge, etc.)

We will need to

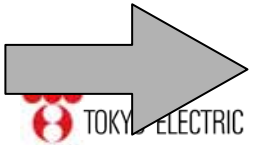
- ✓study of properties
- ✓evaluate for long-term storage
- ✓develop new technologies for the processing and disposal

Introduction of the R&D plan and the its progress

1. Radioactive waste in Fukushima Daiichi Nuclear Power Station

Characteristics of the waste after the accident

- **Influence of injected sea water**
  - Sea water affect disposal, corrosion
  - Influence of injected chemicals to protect corrosion
- **Influence of injected boron, etc.**
  - Boron affect the environment (consider when disposal)
- **A great variety of radioactive waste**
  - Radioactive materials were carried by hydrogen explosions
  - Non radioactive waste change into radioactive waste
- **Influence of core melt down**
  - Nuclides originated fuel distributed various place in plant
  - All waste is treated as trans-uranium waste ??



R&D consider these characteristics

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Example of radioactive waste

Scene	Waste	Dose rate [mSv/h]	Volume of the waste
Treatment for contaminated water	Sludge	Approx 10^3	581 m^3
	Zeolite	Approx 10^1 at vessel surface	346 vessel
	Concentrated liquid waste	Approx 10^2 beta ray	Approx 105,000 m^3
Actives for plant restoration	Debris	Approx from 10^{-3} to 10^3	Approx 34,000 m^3
	Logged tree, Soil	Approx from 10^{-3} to 10^{-1}	Approx 59,000 m^3
	Liquid waste from decontamination	Investigation from now on	–
Dismantling	Waste from decommissioning, decontamination	Investigation in the future	–

As in the second week of Feb., 2012

Secondary waste produced by the treatment of contaminated water (example)

Sludge（made by JAEA）

Tank for concentration liquid waste

Cesium adsorption vessel

Zeolite

Debris (example)

removal

Between Unit 2 and 3

Inside of tent

Area of accumulated debris

2. Outline of R&D roadmap
—towards the disposal —

Framework for R&D

● Planning R&D and progress manegement

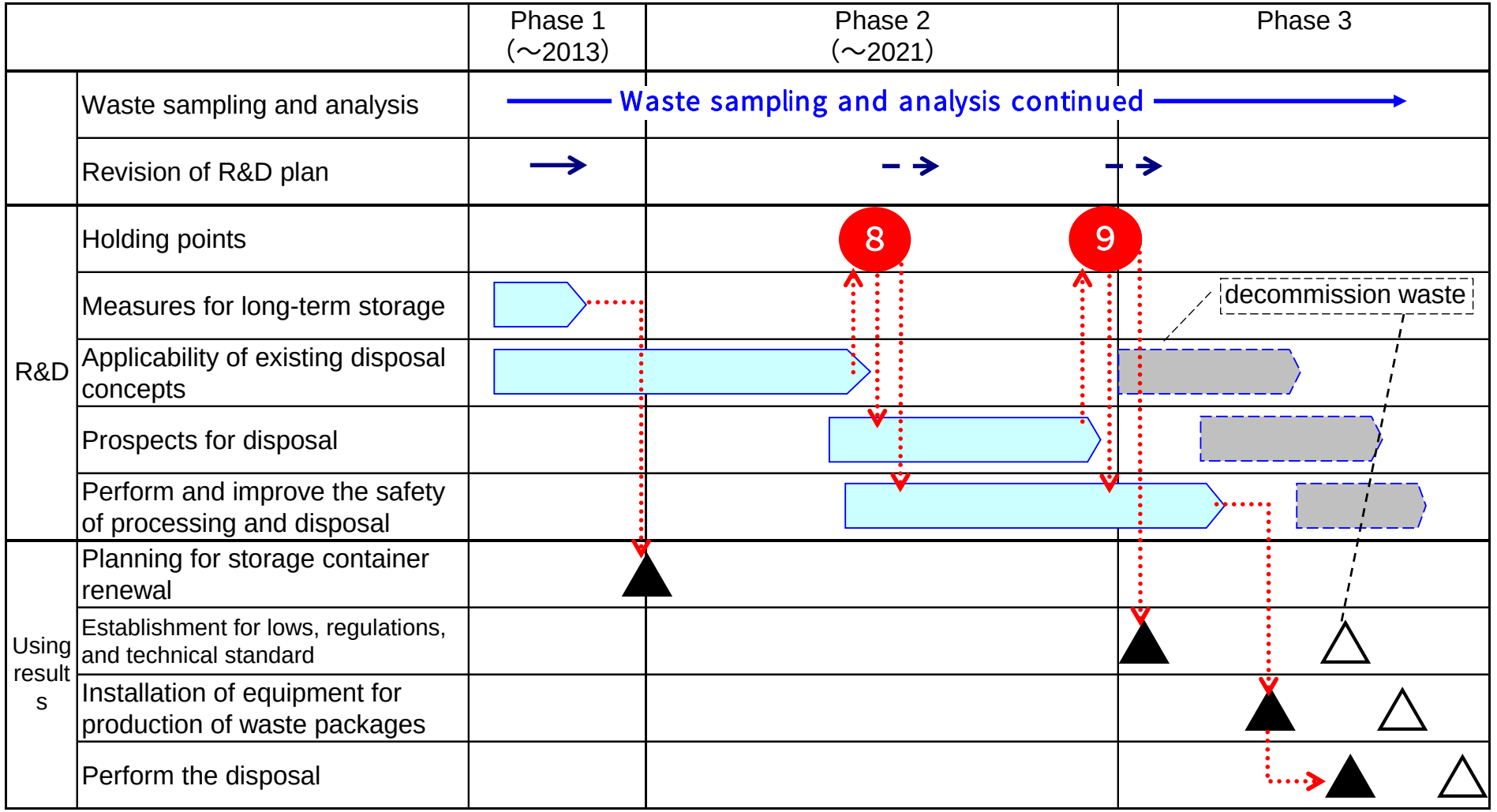
"Research and Development Headquarters" will be planning and progress management overall of R&D

- Working team for radioactive waste processing and disposal
  - ANRE
  - TEPCO
  - JAEA
  - Relevant knowledge and experience, etc.

● Performing R&D

R&D and analysis are performed by JAEA

Outline of R&D roadmap



Holding points (HP): The key points for judgment on progression next step
HP 8: Verification of applicability of existing concepts
HP 9: Verification of prospects for safety

Until HP 8

1. Goals in the near future (from 2012 on)

- Verification of storage (hydrogen, heat generation)
- Evaluation for container life
- Measures for long-term storage
- Planning for detail of R&D plan

2. Confirm the properties of actual wastes

Analysis for few waste (planning)

Radioactive, Chemical component, etc.

Because of difficulty for actual zeolite sampling, the properties evaluated from result of analysis for treated water.

3. Evaluate for applicability of existing concepts

- Prospects for disposal for typical waste
- Identification of problems for typical waste disposal

Until HP 9

1. Confirm the properties of actual wastes

Expand number of results for waste analysis and kinds of waste, Perform actual waste (ex. Zeolite)

2. Solution for problems

Problems regarding existing technologies

3. Confirm of prospects for safety

Compared with the HP 8

- ✓ Condition of safety evaluation is more detailed
- ✓ Prospects for solution to major problems are verified

After HP 9

1. Establishment for lows, regulations, and technical standard

2. Installation of equipment for production of waste packages

3. R&D for dismantling wastes

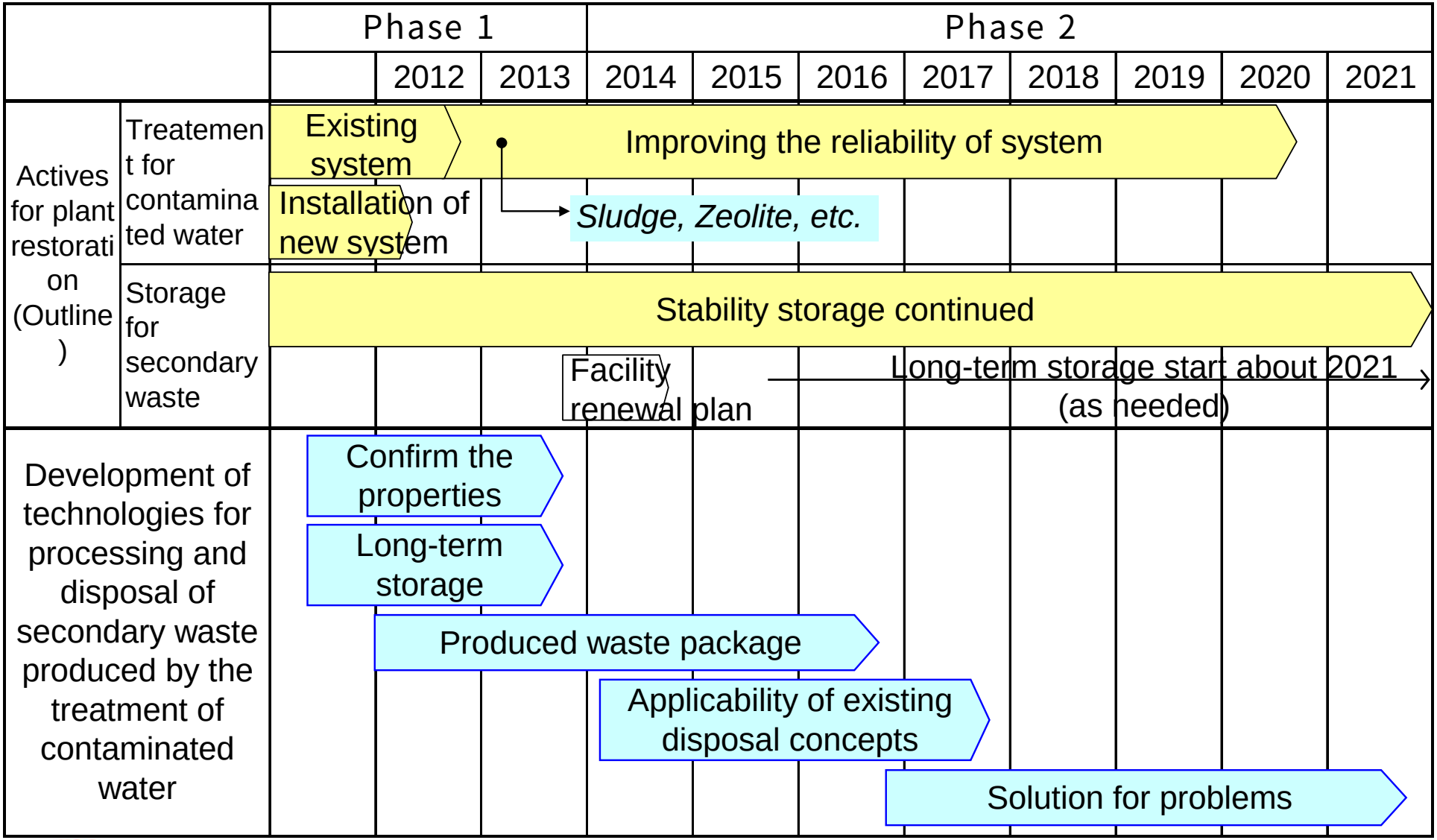
   Confirm the properties of wastes from decommission, decontamination, etc. that produced after HP 9 and R&D for the waste

4. Perform the disposal

   - Site selection
   - Safety evaluation
   - Waste transportation, etc.

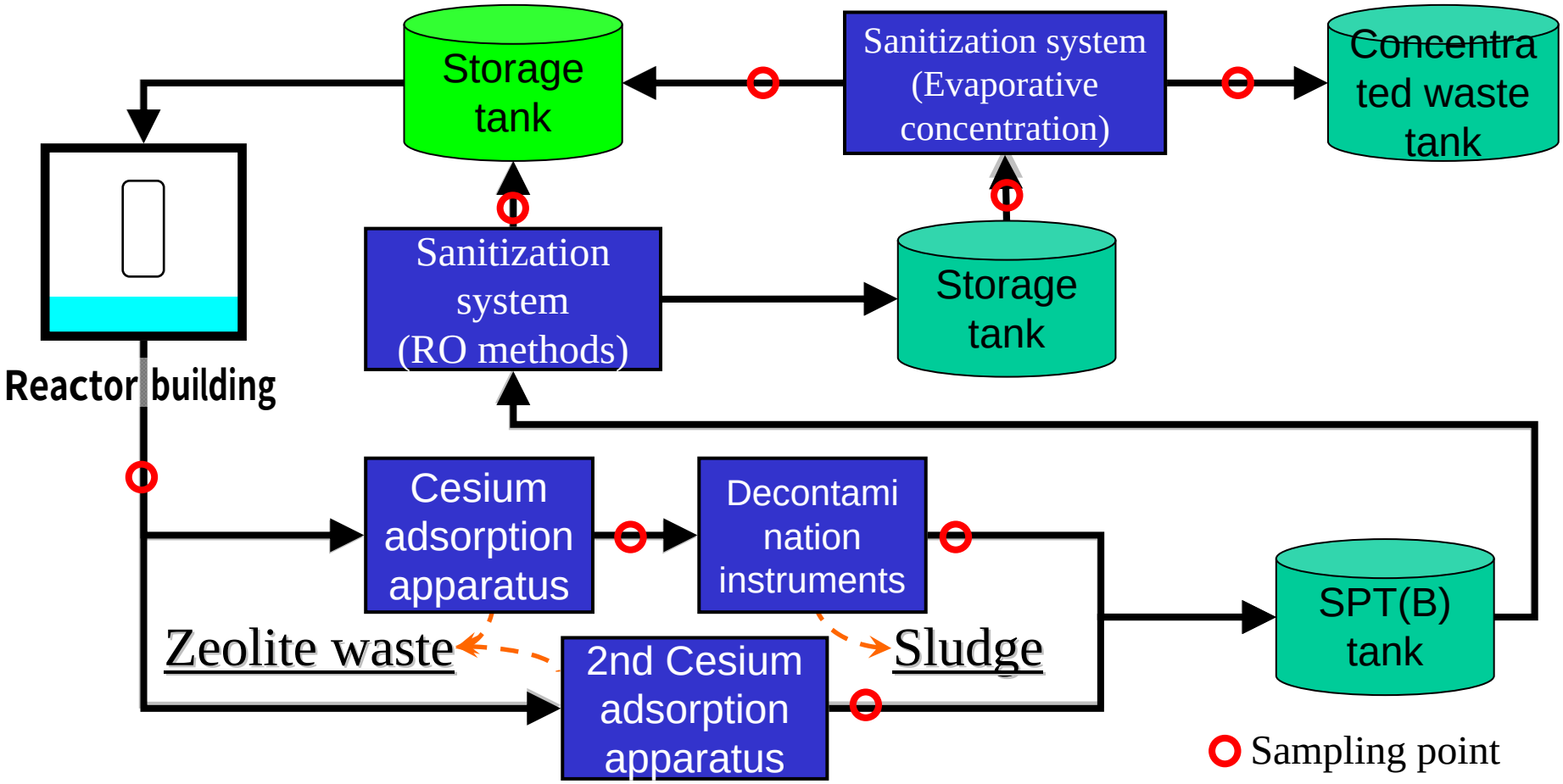
3. Goals in the near future and progress of R&D
—Secondary waste produced by the treatment of contaminated water—

R&D for Secondary waste produced by the treatment of contaminated water



Contaminated water treatment system / Sampling points for radioactive analysis

● Instead of actual waste sampling, the properties evaluated from result of analysis for treated water



● We are considering to sampling method for sludge

Selection for target nuclides on analysis

Selected important nuclides for safety evaluation; L1, L2, L3, High level waste, Trans-uranium waste

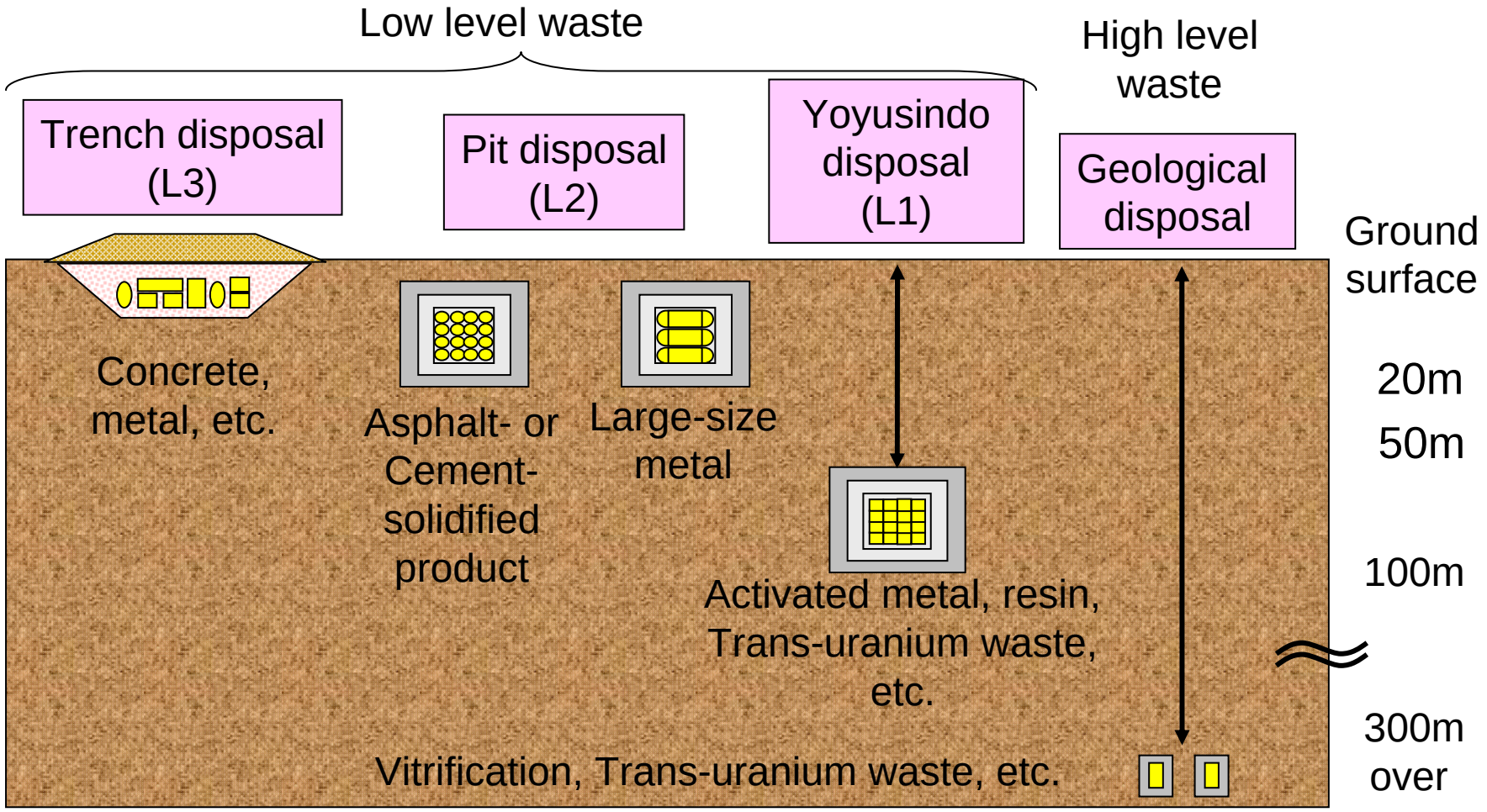


Figure of disposal concepts in Japan classified by radioactive level

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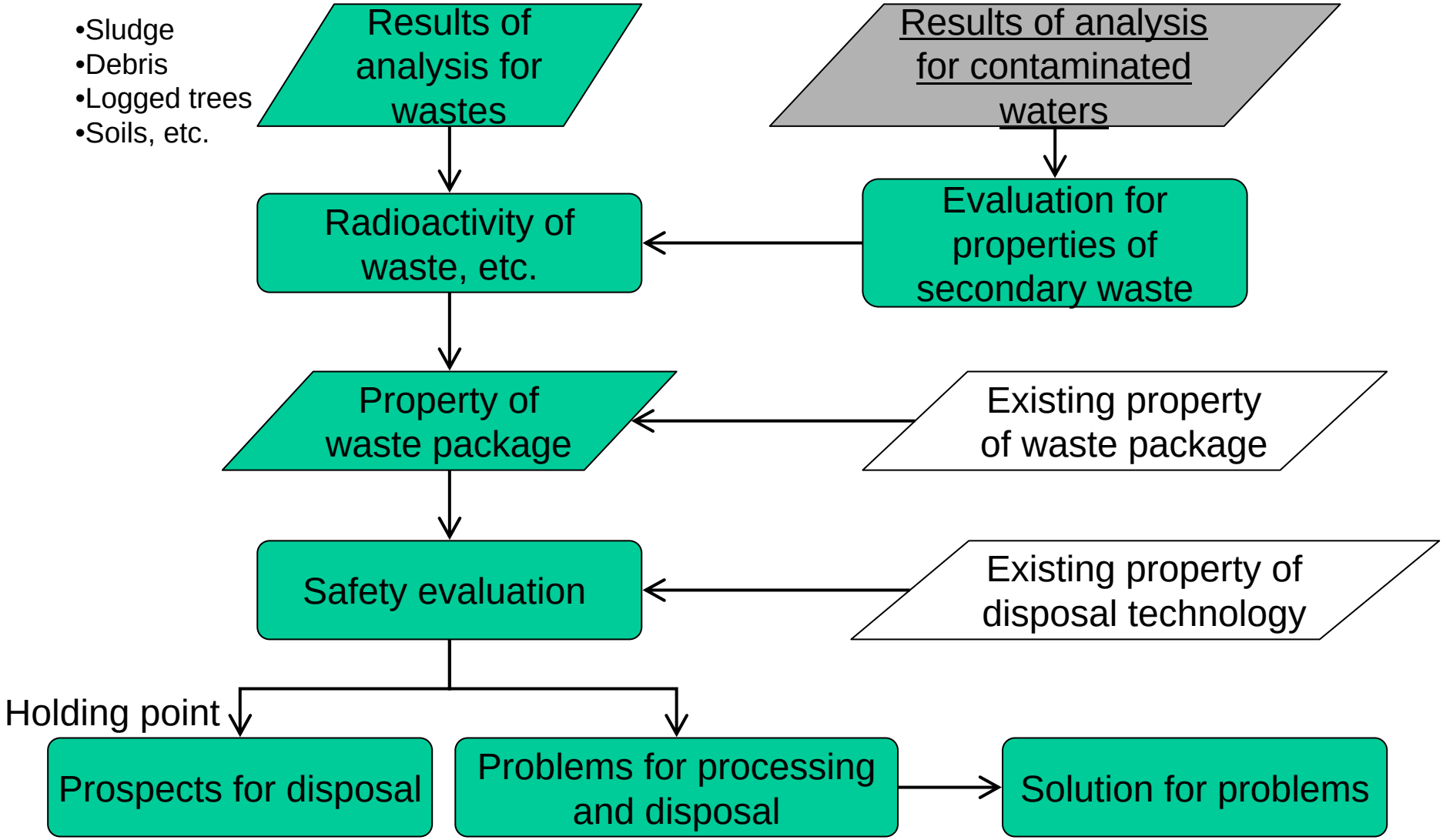
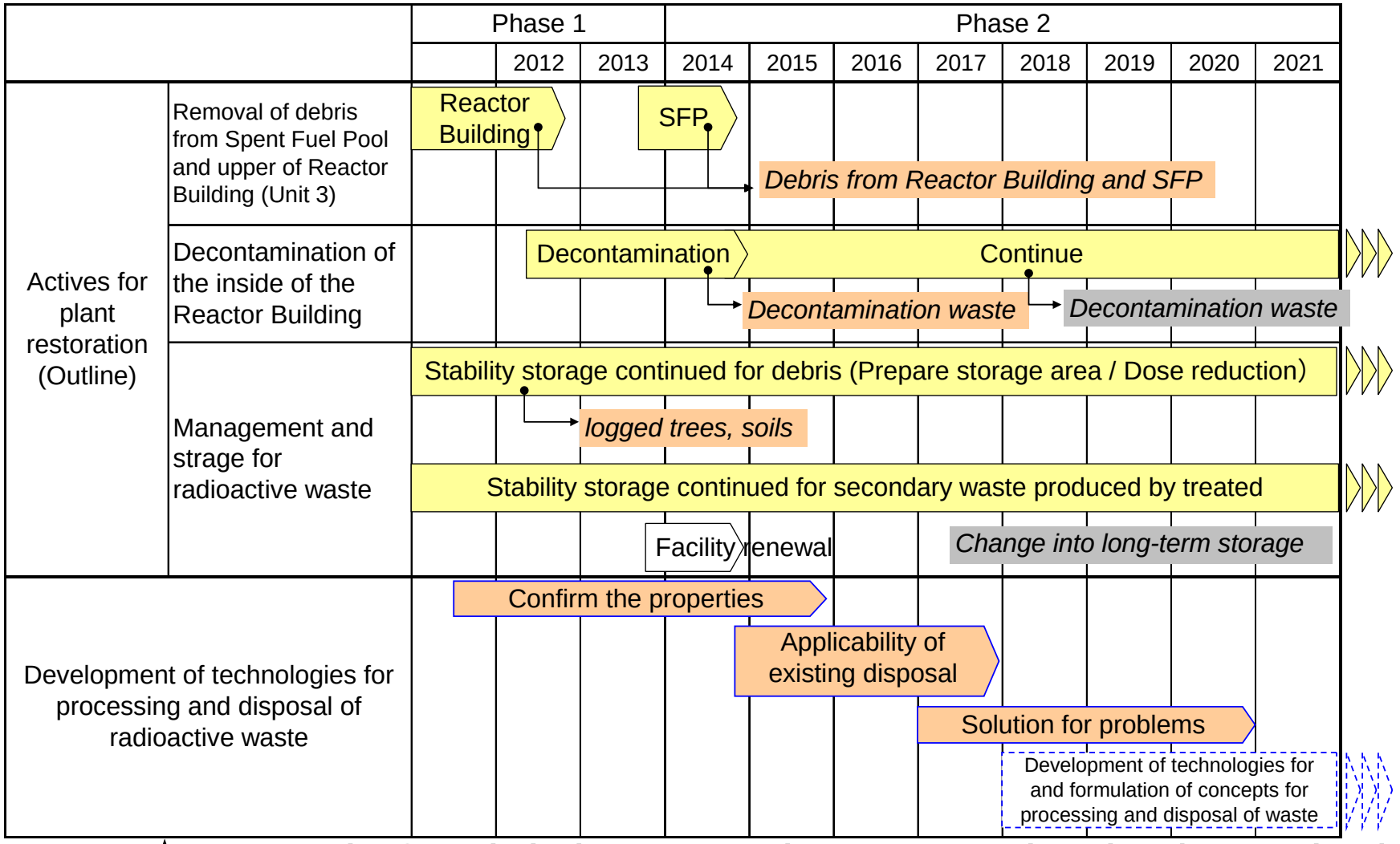
Flow chart for verification of applicability of existing disposal concept



4. Goals in the near future and progress of R&D
－other waste－

R&D for other waste



In 2012

★Analysis for debris, logged trees, and soils (planning)

★Planning for detail of R&D plan

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5. Challenges for R&D

Challenges

1. Sampling of debris, logged trees

Waste grouping method, Number of sample, Typical sample

2. Influence and measure for chlorides

If we except chlorides in the waste, how treated with chloride isotopes.
Reasonable disposal method for chloride

3. Sampling of zeolite inside of cesium adsorption vessel

Because of strong structure and high dose rate, it is difficult to sampling and it is necessary for exclusive instrument to sampling

4. Selection for important nuclides on safety evaluation

Especially in this accident, which nuclide we should consider

5. Systematize and prioritize for processing and disposal of a great variety of waste