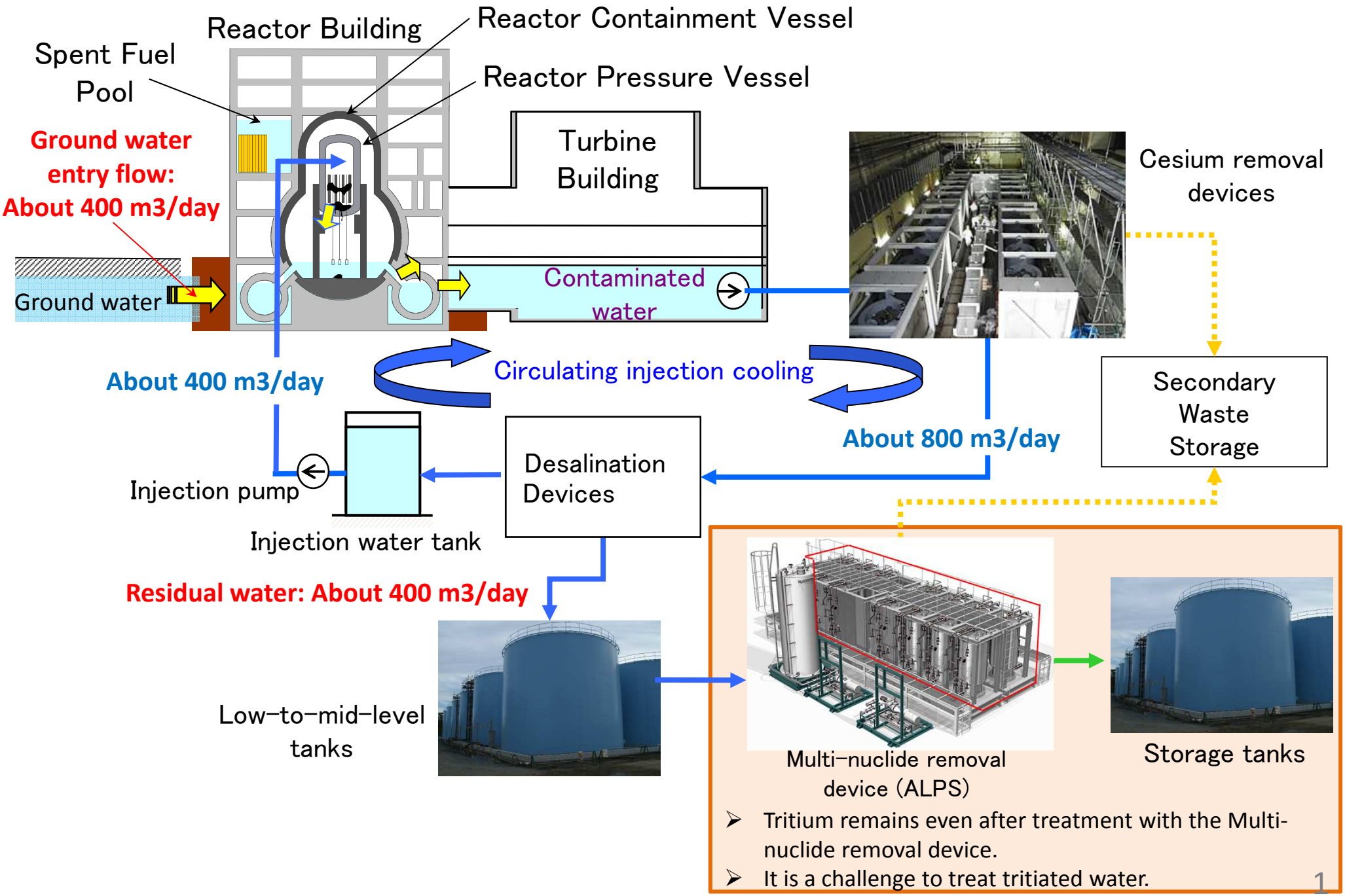
Previous Discussions on the Management for Tritiated Water

June 3, 2014
Ministry of Economy, Trade and Industry
Agency for Natural Resources and Energy
(Cabinet Office, Management Office of the Team for Decommissioning and Contaminated Water Countermeasures)

Contaminated Water Treatment System



Request for Information conducted by International Research Institute for Nuclear Decommissioning (IRID) (1)

■ Inviting technical proposals

◇ A team consisting of experts, such as members of the International Research Institute for Nuclear Decommissioning (IRID), was set up to collect wisdom from both home and abroad and accepted technical proposals (period: September 25 to October 23, 2013).

◇ The collected proposals were closely examined by the "Committee on countermeasures for contaminated water treatment," to reflect the overall image of the preventive and multi-layered contaminated water measures.

■ Status of collection

◇ A total of 780 proposals were submitted. The details are as follows:

Field of information gathered	Number of proposals submitted
(1) Contaminated water storage (Storage tanks, small leakage detection technology, etc.)	206
(2) Contaminated water treatment (Tritium separation technology, long-term, stable tritium storage methods, etc.)	182
(3) Clean-up of seawater in port (Technology to eliminate radioactive Cs and Sr in seawater, etc.)	151
(4) Controlling contaminated water in buildings (Technologies to stop water in buildings and for soil improvement work, etc.)	107
(5) Management of premises to suppress groundwater inflow (Technologies to construct impermeable walls and conduct pavement, etc.)	174
(6) Understanding behavior of groundwater (Geological/groundwater data measurement systems, water quality analysis technology, etc.)	115
Others (Those that do not fall under (1) to (6))	34

(Note 1) The fields are those identified in the proposer's application.
(Note 2) Some proposals were related to two or more fields.

◇ Technical proposals presented from both inside and outside of Japan are precious data that provide a complete picture of technologies for contaminated water treatment.

◇ Taking into consideration the maturity of technologies, the urgency of response, and adaptability of technologies to the site, the following technologies were selected:

◇ (1) Technologies that should be adopted after confirming their adaptability to the site:

- High-reliability, large-size tanks such as double-shell steel tanks
- Lightweight shielding sheet that does not use lead
- Contamination prevention membrane (silt fence, etc.)
- Water stopping technology (stopping water in and around buildings)
- Geological/groundwater survey, preparing observation network etc.

(2) Technologies to be used by selecting an execution method based on workability and cost effectiveness

- Water shut-off technologies (pavement, water shut-off, etc.)

(3) Technologies that are expected to be effective but need to be checked and verified before being used

- Small leakage detection technology (including dyes)
- Tank decontaminating technology without using water
- Tritiated water storage and separation technologies
- Technology for cleaning up seawater in port
- Technology for capturing strontium in soil
- Automated boring technology, etc.

(4) Technologies to be pushed forward based on study by the Committee on countermeasures for contaminated water treatment

- General assessment of handling of tritiated water
- Study on issues related to tankers and underground storage, etc.

Request for Information conducted by International Research Institute for Nuclear Decommissioning (IRID) (2)

(Reference) Comments from the Expert Review Panel

- ✓ From the international experience of the comprehensive evaluation carried out by the OSPAR Commission of the EU, or by European countries and the U.S., tritium could be separated theoretically, but there is no practical separation technology on an industrial scale. Accordingly, a controlled environmental release is said to be the best way to treat low-tritium-concentration water.
- ✓ Although there are many proposals about tritium separation technologies, there is no innovative proposal that will significantly improve the separation performance of the CECE process which is, from past knowledge and experience, the most promising system.
- ✓ When reviewing these technologies for application to the Fukushima Daiichi nuclear power plant, expected development time, size and cost, as well as risk of separation should be taken into account.
- ✓ Although many proposals were submitted, there was no proposal that showed an immediate applicability to the Fukushima Daiichi nuclear power plant.
- ✓ On the other hand, it is important to keep collecting information on the updates of various technologies which are in the research phase.

※The comments from the Expert Review Panel can be viewed here:
(Japanese)
http://irid.or.jp/cw/wp-content/uploads/2013/11/RFI_Result1115_1_2.pdf
(English)
http://irid.or.jp/cw/wp-content/uploads/2013/11/RFI_Result1118_1_21.pdf

Evaluation of the IAEA Review Mission

- Invitation of the IAEA Review Mission with regard to activities toward the decommissioning of Fukushima Daiichi Nuclear Power Plant from November 25 to December 4, 2013
- The report of the review was released on February 13, 2014, and the report advises that "every alternative should be verified."

－Excerpt from Report of the Review Mission－

The IAEA team believes it is necessary to find a sustainable solution to the problem of managing contaminated water at TEPCO's Fukushima Daiichi NPS. This would require considering all options, including the possible resumption of controlled discharges to the sea. TEPCO is advised to perform an assessment of the potential radiological impact to the population and the environment arising from the release of water containing tritium and any other residual radionuclides to the sea in order to evaluate the radiological significance and to have a good scientific basis for taking decisions. It is clear that final decision making will require engaging all stakeholders, including TEPCO, the NRA, the National Government, Fukushima Prefecture Government, local communities and others.

Source：Homepage of IAEA

Preventive and Multi-layered Measures for Decommissioning and Contaminated Water Management

Decided by Nuclear Emergency Response Headquarters on Dec. 20, 2013

1. Preventive and Multi-layered Measures against Contaminated Water Issue

1) Remove sources of contamination

key measures already being implemented or decided:

- Remove contaminated water in the trenches and isolate the trenches
- Treat contaminated water with multi-nuclide removal equipment (ALPS)
- Install high-performance multi-nuclide removal equipment at government expense

Key additional measures:

- **Install more multi-nuclide removal equipment**
- **Take measures to prevent water leakage from tanks (capturing strontium contained in the soil)**
- **Clean up sea water in the harbor**

2) Isolate water from contamination

key measures already being implemented or decided:

- Pump up groundwater for by-passing
- Pump up ground water from sub-drains near buildings
- Install land-side frozen soil impermeable walls at government expense
- Pave the area between building and sea

Key additional measures:

- **Implement "broader area pavement (surface waterproofing) in the site" or "limited area pavement with an impermeable enclosure," also consider dose-reduction measures (e.g. decontamination of land surface)**
- **Install gutters on top of tanks**

3) Prevent leakage of contaminated water

key measures already being implemented or decided:

- Improve soil with sodium silicate
- Install sea-side impermeable walls
- Install further tanks (replace bolted-joint tanks with welded-joint tanks)

Key additional measures:

- **Accelerate installation of welded-joint tanks**
- **Prepare countermeasures against large tsunami (e.g. install watertight doors on buildings)**
- **Prevent contaminated water leakage from buildings**
- **Reduce length of contaminated water transfer piping**

- **Need to accelerate installation of further tanks to the extent possible with combined efforts of public- and private-sectors**, such as encouraging cooperation of relevant business operators, together with acceleration of installing welded-joint tanks, in order to secure enough storage capacity of tanks in preparation for waves on the surface of the liquid caused by earthquake.

- Press forward the **efforts such as verification of technology with Fiscal Year 2013 Supplementary Budget** for the additional **measures with high technical difficulty** such as the measures to clean up the sea water in the harbor and to remove radioactive materials in the soil.
- Make **a comprehensive evaluation of all options** for **tritiated water**, which still has remaining risks, as soon as possible and consider appropriate measures.

2. Enhanced Communication as a Measure to Prevent Damage to Reputation

- Provide evidence-based information in an internationally open manner. Under the cooperation of relevant ministries, enhance the integrated communication of the Team for Decommissioning and Contaminated Water Countermeasures.

Discussions in the Task Force for Tritiated Water (1)

- In the “Preventative and Multilayered Measures for Contaminated Water Treatment at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company - Through completeness of comprehensive risk management -”, it was decided to evaluate various options comprehensively with regard to tritiated water. Following this decision, the “Task Force for Tritiated Water” was set up under the Committee on Countermeasures for Contaminated Water Treatment.
- Purposes of the task force are to select various options such as separation, storage, release, etc. as basic information, and to clarify items to be evaluated such as risks, environmental impacts, cost-benefit, etc. for each selected option, so that a comprehensive evaluation can be done.
- The task force has been convened 8 times altogether through April 2014. Various options and items to be evaluated have been clarified through discussions with invited oversees experts, etc.

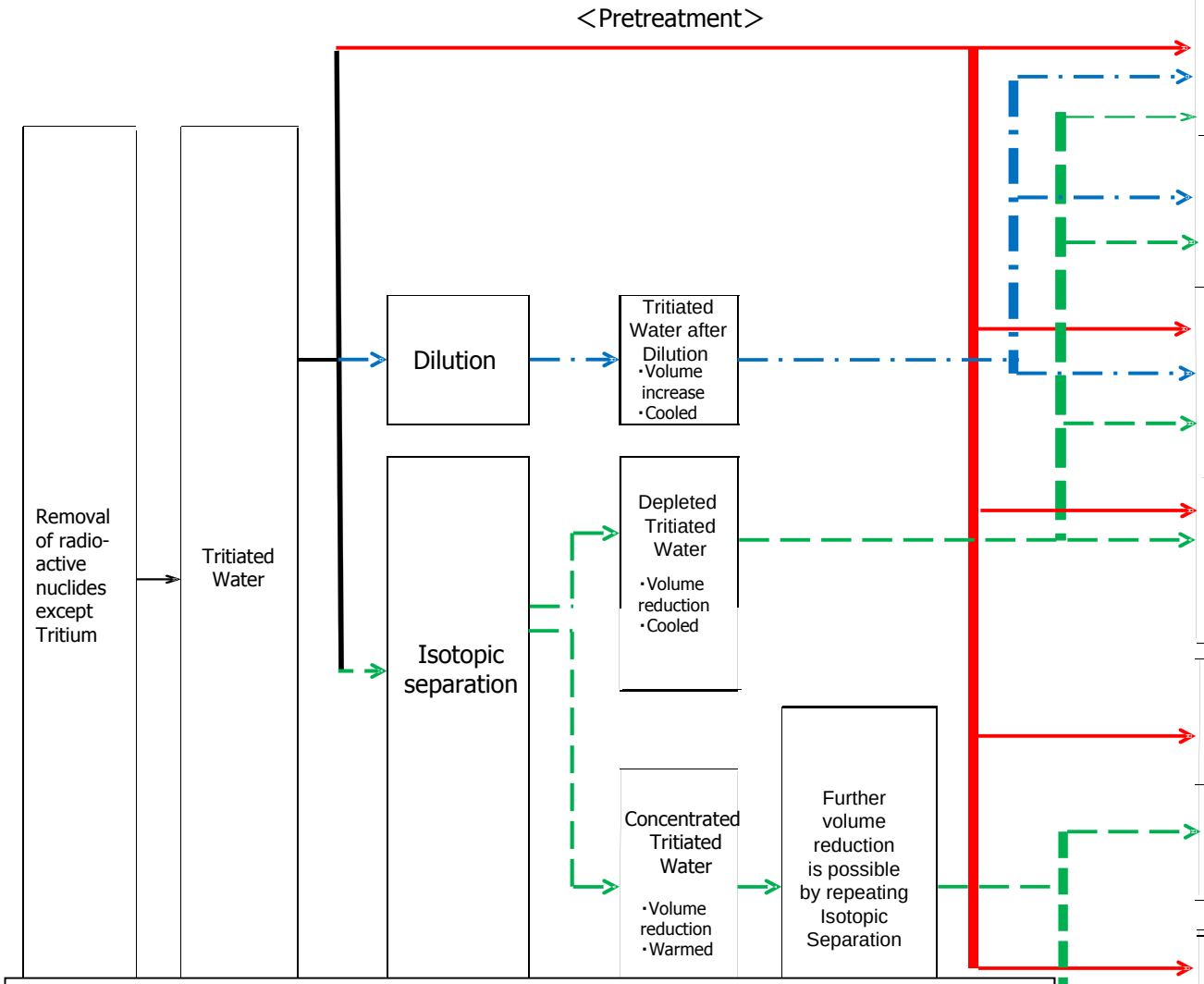
(Reference) “Summary of previous discussions”
http://www.meti.go.jp/earthquake/nuclear/pdf/140428/140428_01f.pdf

Previous agenda

12/25	First	Regarding procedure of the task force
1/15	Second	Regarding separation technology and underground storage, various options and items to be evaluated
2/7	Third	Regarding items to be evaluated (concept of environmental dynamics and influences)
2/27	Fourth	Regarding items to be evaluated (dispersal in the environment, etc.)
3/13	Fifth	Regarding oversees examples (France, UK)
3/26	Sixth	Regarding oversees examples (USA, UK)
4/9	Seventh	Regarding oversees examples (France)
4/24	Eighth	Regarding summary of previous discussions

Discussions in the Task Force for Tritiated Water (2)

Options and Challenges for the Final Form of Tritium Disposition



Disposal method	Major challenges, etc.	Destination
Injection and disposal into geological formation	○Decision on method of underground injection (selection of geological formation, injection speed, temperature, etc.) ○Evaluation of the dissipation behavior after underground injection ○Evaluation of impacts on human body, etc. after dissipation ○Development of the system to trace the behavior after injection	Under-ground
Release to the sea	○Decision on method to release to the sea (destination of release, amount of release, temperature, etc.) ○Evaluation of the dissipation behavior after release ○Evaluation of impacts on human body, etc. after dissipation ○Development of a system to trace the behavior after release	Sea
Release to the atmosphere in the form of steam	○Decision on the method to release to the atmosphere in the form of steam (speed of release, temperature, etc.) ○Evaluation of the dissipation behavior after release as steam ○Evaluation of impacts on human body, etc. after dissipation ○Development of a system to trace the behavior after release as steam	Atmo-sphere
Release to the atmosphere as hydrogen gas after reducing to hydrogen	○Decision on the method to release into the atmosphere (speed of release, temperature, etc.) ○Evaluation of the dissipation behavior after release ○Evaluation of impacts on human body, etc. after dissipation ○Development of a system to trace the behavior after release to the atmosphere	
Underground burial and disposal after solidification or gelification	○Decision on the location and the method of burial ○Evaluation of dissolution behavior from concrete, etc. ○Evaluation of impacts on human body, etc. after dissolution ○Development of the system to trace the behavior after dissolution	Under-ground
Disposal of small amount of highly concentrated tritiated water	○Selection of the method of disposal ○Assurance of locations for disposal	
Storage of significant amount of tritiated water	○Establishment of an approach to store tritiated water safely for a long time ○Establishment of a permanent control approach ○Assurance of locations and tanks for storage	Facilities
Storage of small amount of highly concentrated tritiated water	○Selection of the storage/disposal method ○Establishment of a permanent control approach ○Assurance of locations for storage and tanks for storage	

Items to be evaluated:
- Impacts and risks to the environment, marine products and human bodies, treatment period, costs for the solution
- Technical feasibility (technical maturity, technical applicability, domestic and foreign experiences)
- Certainty of operation (incl. availability of means to confirm safety, suitability for regulations, possibility of damages caused by harmful rumors), etc.

Discussions in the Task Force for Tritiated Water (3)

Items to be considered and challenges going forward

It is necessary to consider items to be evaluated more specifically for each selected option.

<Examples of specific consideration items>

- Technical feasibility:
  - Demonstration experiments for validation of technical feasibility of separation technology, etc. as needed.
- Impacts and risks to the environment, marine products and human bodies, costs, work period:
  - To define simple concepts (location, transportation, facilities, etc.) for each option, and to provisionally calculate impacts and risks, and costs or work period needed for the disposal itself such as installation of facilities.
- Others:
  - The way to communicate with stakeholders (including the method to announce and transmit evaluation results of each option and data regarding them. However, the task force does not cover the issue of stakeholders' acceptance.)

etc.

Verification of technologies for contaminated water management project (Demonstration Project for Verification Tests of Tritium Separation Technologies)

1. Purpose of the project
- To gather the latest information on tritium separation technology on the basis of the technical information offered to IRID, previous considerations in the Task Force for Tritiated Water.

2. RFP Topics
- In order to validate the separation technology of the tritiated water arising in the Fukushima Daiichi Nuclear Power Station, conduct verification tests that will enable evaluation of separation performance, construction costs and operating costs, using equipment, the scale of which is left to the implementing entity's discretion

3. Duration of the project
- From the date of the grant decision to March 31, 2016

Timeline

May 15, 2014 Commencement of the application
June 3, 2014 Information session
July 17, 2014 Deadline of the application

After the deadline, proposals will be reviewed and evaluated, followed by decision of the adopted entities.