The Decommissioning Research and Development Plan for FY2025

List of Individual Decommissioning Research and Development Plans for Next FY

Engineering and Investigation of Next Measures by Operating Entities

[B] Scaling up Retrieval of Fuel Debris

[B1] Work Environmental Improvement Inside and Outside of Reactor Building

- [B1] Development of Technologies for Work Environmental Improvement in Reactor Building (～FY2025) (continued)

[B2] Investigation Inside of PCV/RPV, Fuel Debris Characterization

- [B2②] Development of Investigation Technology of Inside of RPV (～FY2025) (continued)
- [B2③] Development of Analysis and Estimation Technology for Characterization of Fuel Debris (～FY2026) (new)

[B3] Retrieval System, Safety System, Maintenance System, Storage Equipment

- [B3①] Development of Fuel Debris Retrieval Method (～FY2026) (new)
- [B3②-2] Development of Analysis Technology for Contamination Monitoring (～FY2025) (continued)
- [B3②-3] Development of Technologies for Evaluation of Impact Assessment due to Dust Dispersion (～FY2026) (new)
- [B3②-4] Technology Development of Analytical Method for Exposure Dose Evaluation (～FY2026) (new)
- [B3④] Development of Technologies for Containing, Transportation and Storage of Fuel Debris (～FY2026) (new)
- [B3⑤] Development of Assistive Technologies for Integration Management of Decommissioning of the Fukushima Daiichi Nuclear Power Station (～FY2025) (continued)

[C] Waste Management

- [C] Research and Development of Processing and Disposal of Solid Waste (～FY2026) (partially new)

Legend

Research and Development Supported by METI

B1：Development of Technologies for Work Environmental Improvement in Reactor Building（continued）

Purpose

Towards the scaling up retrieval of fuel debris and internal structures, technology development related to work environmental improvement shall be implemented as it is necessary for the safe and efficient work inside the Reactor Building(R/B) where there are still places with the damage status caused by the accident is unknown and the dose rate is still high.

Implementation Content

○Prior to fuel debris retrieval, environmental improvement is necessary for safe and efficient preparatory work for construction of access route in R/B, where there are still places with unknown damage status caused by the accident and high dose rates. As an important technical element of the environmental improvement, it is necessary to have the technology for safe and certain removal of high dose Primary Containment Vessel (PCV) penetration pipes which have a possibility to include contaminated fluid, hydrogen etc. Regarding technologies and equipment related to it, in order to enable its on-site applicability, development shall be implemented by research, examination, element tests considering that environmental improvement is required at any time of fuel debris retrieval period.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1.Development of Systems for Remote Monitoring and Removal Operation for Removal of PCV Penetration Pipes .

Pipes etc. penetrating PCV have a high dose part where pipes, devices and facilities are crowded in the narrow area where there is a possibility that contaminated fluid, hydrogen etc. are included. In order to conduct safe and certain removal operation for crowded pipes etc., it is required to stabilize posture of the remote device and conduct operations by the position control with high accuracy, as well as coordinate appropriate operation with prevention of fluid leakage and the operation monitoring device. In addition, for the removal operation inside of R/B, the following operations are necessary: preparatory operations such as survey/measuring operation, arrangement of materials and equipment, on-site curing, collecting internal matters from inside of the pipes and post-processing operations such as containing, transportation etc. Since the staff engaged in monitoring and these operations tend to have higher exposure dose, an operational system which will minimize human intervention in the operating area by means of remote monitoring etc. is required.

Therefore, in order to remove PCV penetration pipes etc. inside of R/B, remote removal operation system collaborated with autonomous remote monitoring of the works status shall be developed. PCV penetration pipes etc. in each unit shall be surveyed, and the operating method and system specification based on the contents of on-site works corresponding to the series of removal process from preparation to post-processing shall be surveyed and investigated, so the necessary functions and elemental technologies for the remote monitoring and removal operation system shall be extracted. Further, based on the existing technologies after setting the development tasks, a prototype shall be manufactured and elemental tests shall be conducted as well as on-site applicability shall be verified and investigated through combination tests corresponding to the series of process using simulants. Furthermore, specifications and operation methods of remote monitoring and removal operation system shall be proposed for the actual operations corresponding to the tasks extracted by the evaluation.

（Notes）

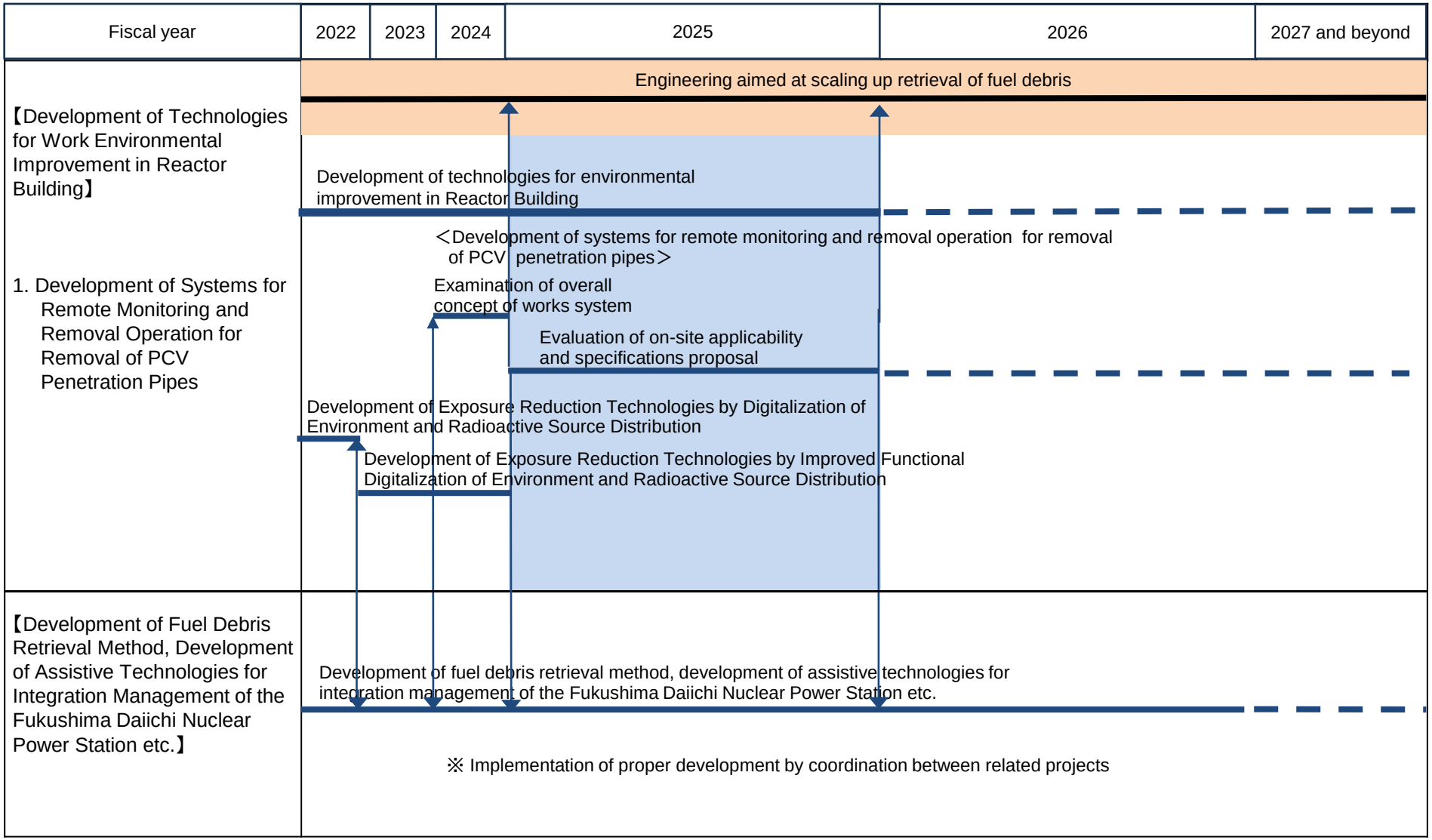
In this project, the development shall be implemented considering the following handling characteristics and maintenance methods:

- It should be basically performed via remote control because it should be performed in a high dose area
- It is necessary to consider contamination and decontamination of the equipment
- The work areas for maintenance are limited
- Waste generated by maintenance operation should be minimized

Definition of criterion for judgment on objective achievement

- Evaluation of on-site applicability and proposal of specifications of systems for remote monitoring and removal operation for removal of PCV penetration pipes etc.（FY2025）

（Implementation schedule）B1：Development of Technologies for Work Environmental Improvement in Reactor Building



B2②: Development of Investigation Technology of Inside of RPV（continued）

Purpose

In order to contribute to consideration concerning fuel debris retrieval from inside of Reactor Pressure Vessel (RPV), the investigation technology for grasping the situation with fuel debris etc. inside of RPV shall be developed

Implementation Content

○In order to verify the situation inside the RPV including internal conditions, radiation dose etc. ensuring confinement functions by remote operation under the environmental conditions of high radiation, high contamination etc., the drilling device to construct an access route (new opening work etc.) and the device and system to carry investigation equipment into RPV shall be developed.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1.Development of the Access-from-Top/Side Investigation Method

As a new access route inside the RPV, Access-from-Top/Side Investigation Method to drill PCV head and RPV head from the side starting from the dryer separator (DS) pit is considered. As it is possible to do without providing an opening in the highly contaminated shield plugs, there is a possibility to investigate earlier than Access-from-Top Investigation Method. Referring to developed by FY2019 Access-from-Top Investigation Method as well as Access-from-Side Investigation Method, the development plan for necessary elemental technologies shall be formulated for on-site application of the Access-from-Top/Side Investigation Method starting from DS pit, and the entire conceptual design of the device shall be created based on this development plan. Furthermore, for technical tasks like drilling of DS slot plugs etc. or sealing of the penetration part of PCV head, elemental tests shall be conducted and the possibility to achieve the required functions shall be verified.

In addition, based on the examination of fuel debris retrieval method, if the new investigation tasks of the Access-from-Top Investigation Method to drill shield plugs are clarified, necessary developments for technical tasks shall be conducted.

2.Development of the Access-from-Bottom Investigation Method

As an Access-from-Bottom Investigation Method, by FY2023 there has been developed the method to access inside of the pedestal through X2 penetration/CRD opening to investigate by a drone, and the method to access inside of the pedestal through X6 penetration/CRD opening by robot arm (assumed the arm for Fuel Debris Retrieval Gradually Expanded Its Scale) to investigate by a telescopic pipe and their on-site applicability was confirmed. However, based on the results of the previous PCV internal investigations, and because many obstacles were confirmed inside of the

(Continuation of 2.)

pedestal, for investigation inside of the pedestal and the bottom of RPV, it is necessary to develop an investigation device capable of more flexible movement. There shall be developed a device (arm etc.) to access inside the pedestal through existing penetration/CRD opening, and a device for access and investigation capable to relocate the investigation device inside of the pedestal upwards flexibly and to insert from outside of RPV bottom to inside of RPV. Also, it shall be the device able to remove obstacles if necessary. Conceptual design shall be made and the achievement of required functions shall be verified by manufacturing of prototype and in-factory test.

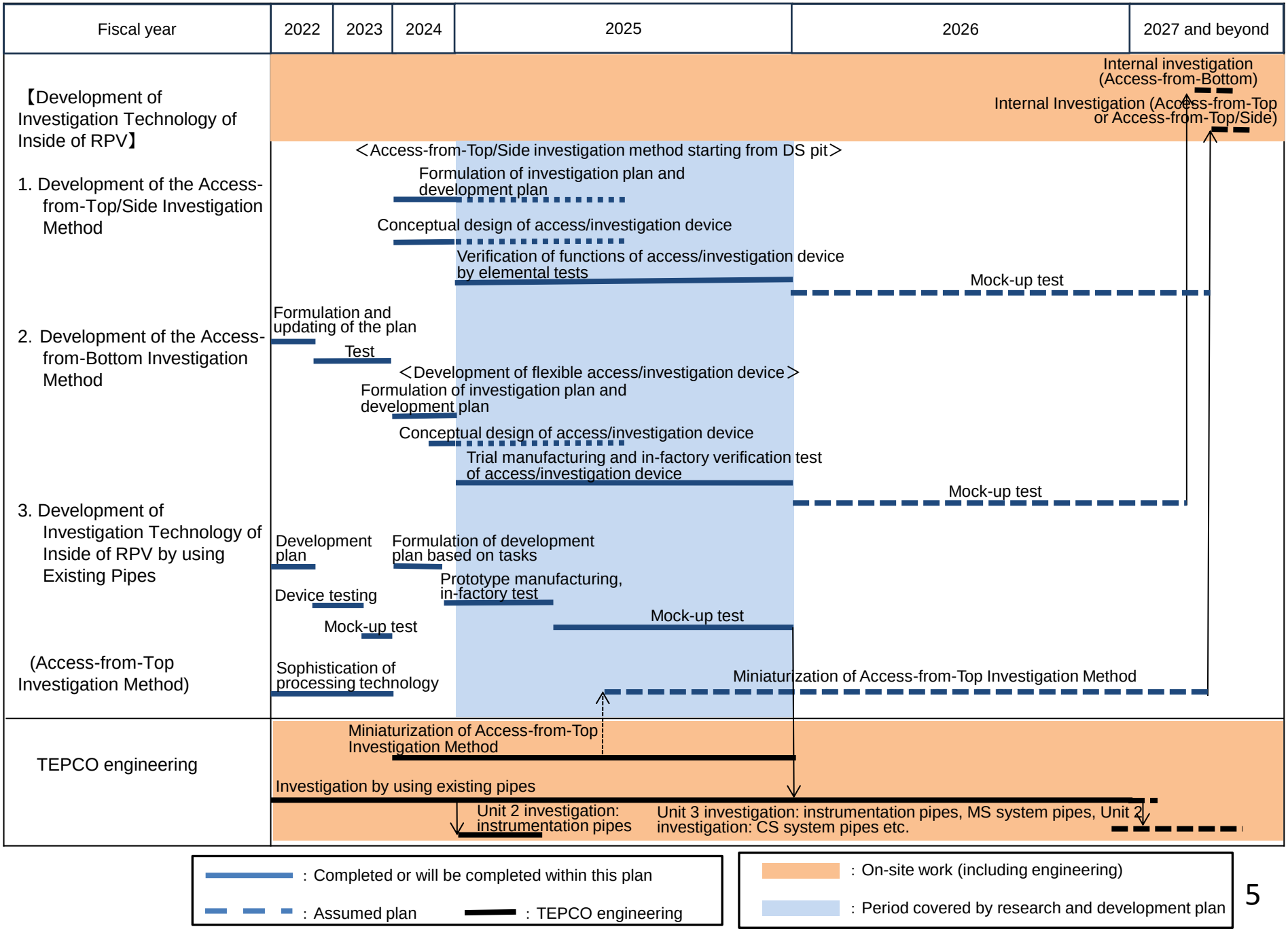
3. Development of Investigation Technology of Inside of RPV by using Existing Pipes

By FY2023, as existing pipes which can be used for investigation in RPV based on access route and on-site environment core spray (CS) system, main steam (MS) system and primary loop recirculation (PLR) system were selected, necessary functions requirements for route construction, movement inside pipes and confirmation of the conditions inside reactor were summarized. Device prototype was developed and on-site applicability was confirmed by mock-up tests. In this project for tasks identified by results of mock-up tests review and improvement of each device shall be made and on-site application shall be reconfirmed through mock-up tests.

Definition of criterion for judgment on objective achievement （FY2025）

- Function confirmation by elemental tests based on plan of development of Access-from-Top/Side Investigation Method starting from DS pit and conceptual design of device etc. (FY2025)
- Function confirmation by prototype and in-factory tests based on conceptual design for Access-from-Bottom investigation device (FY2025)
- Confirmation of on-site applicability by mock-up tests based on design improvement of device for internal investigation using existing pipes (FY2025)

（Implementation schedule）B2②：Development of Investigation Technology of Inside of RPV



B2③: Development of Analysis and Estimation Technology for Characterization of Fuel Debris (new)

Purpose

In order to contribute to the development of fuel debris retrieval method and internal structures and technologies for containing, transportation and storage of fuel debris, technology necessary for quantitative analysis of components and estimation for characterization of fuel debris shall be developed.

Implementation Content

○Fuel debris generated by unprecedented BWR core meltdown accident have heterogeneous compositions affected by a reaction with concrete and seawater injection etc. and include many poor solubility isobars and fission products. Therefore, technology for analysis and estimation aimed at characterization of fuel debris which include many uncertainties such as formation process shall be developed.

○The estimation technology for fuel debris characterization shall be developed using analysis and evaluation of on-site samples, then the methods of estimation for characterization of fuel debris and display of PCV internal damage condition shall be sophisticated and also analysis accuracy shall be improved.

○In order to realize safe and efficient retrieval and storage of fuel debris, the technologies for abbreviated analysis of the existence of fuel components and for non-destructive determination of fuel content in fuel debris shall be developed.

○The results of this research shall be used in the engineering conducted by the operating entity.

1.Development of Analysis and Estimation Technology for Characterization of Fuel Debris

(1) In order to implement safety assessment of criticality control, storage management etc. for fuel debris retrieval, it is necessary to understand fuel debris properties. But fuel debris generated by BWR accident is unprecedented, it is difficult to analyze fuel debris characterization because of their insolubility and inclusion of many isobars and fission products in addition to reaction with concrete, sea water injections and unknown temperature history during the formation process. In order to clarify chemical composition of fuel and fission products in fuel debris as well as isotope ratios, elements mapping, metal structure, crystal structure etc., technology for analysis of fuel debris shall be developed. Furthermore, fuel debris obtained in trial retrieval or samples of sediments and deposits obtained by internal investigation shall be transported to research institutes with hot lab facilities and mentioned above items shall be analyzed.

The analysis of samples obtained from reactor building of Fukushima Daiichi Nuclear Power Station shall be given highest priority, and to improve analysis accuracy comparative data shall be obtained. For example, using the fuel debris from the accident of the US Three Mile Island Nuclear Power Station Unit 2 as a sample for analysis, pretreatment process shall be made more efficient, exposure reduction measures during handling etc. shall be examined, and at the same time comparative data shall be obtained. Based on analytical data regarding fuel debris, the fuel debris generation process and the accident progression shall be estimated, and it shall be reflected in examination of safety measures and storage management. And the results of analysis and evaluation shall be provided for various decommissioning processes related to fuel debris retrieval. By attending global round robin tests for simulant of fuel debris analysis, it should be confirmed that Japan has sufficient abilities for fuel debris analysis and at the same time knowledge of analysis and evaluation of foreign research institutes shall be acquired. Regarding mentioned above, the discussions shall be held with the participation of Japanese and foreign experts in order to proceed while adopting knowledge from these discussions.

(2) The data acquired in the previous investigation inside PCV mainly consists of images/pictures and air radiation dose rate, but the routes where the melted fuel flowed down, locations with large portions of fuel etc. are not clear. For effective retrieval of fuel debris, it is necessary to identify damaged areas, damage situation and location where the fuel has fallen inside PCV. Based on new findings from sample analysis, inside investigation, reproduction test etc. consistency with accident progression analysis shall be evaluated. Especially, inside the concrete pedestal of Unit 1, the rebars and inner skirt are exposed, which is different from what was assumed regarding molten core – concrete interaction (MCCI). Also, there is a lot of sediments outside of the concrete pedestal and the situation in the lower part of these sediments is unclear.

B2③: Development of Analysis and Estimation Technology for Characterization of Fuel Debris (new)

Along with analysis and evaluation of fuel fall locations, temperature rise inside pedestal, reaction with concrete, molten material situation, etc., the situation with fuel distribution shall be estimated. For effective display and understanding of obtained results, the estimation chart of the state inside of PCV shall be prepared in three-dimensional CG.

2.Development of Technology for Abbreviated Analysis and Non-destructive Measurement of Fuel Debris

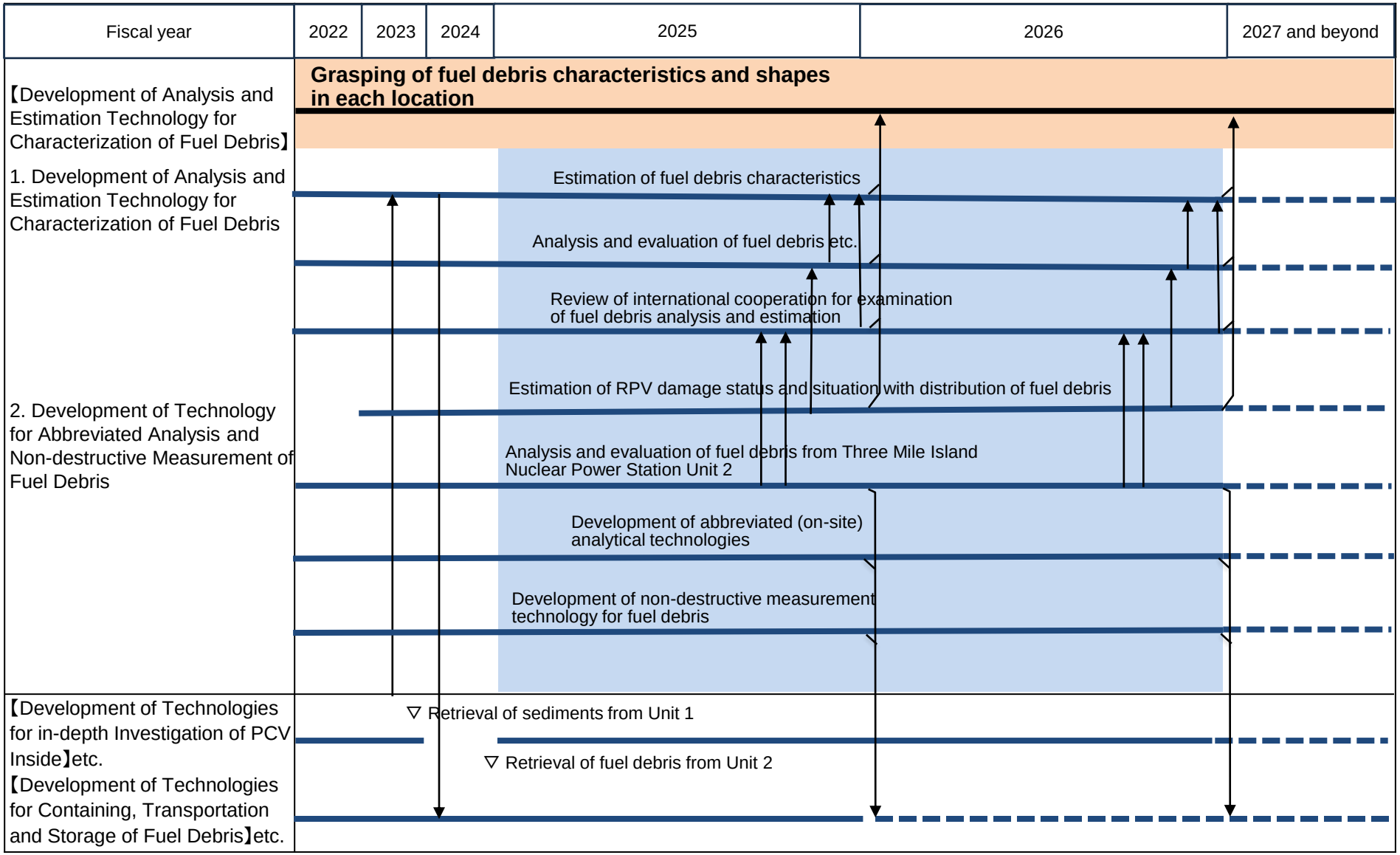
(1) In order to confirm that fuel is included in applicable objects during fuel debris retrieval works, each time it is necessary to transport them to hot lab facilities and analyze. As some time and resources are needed for transportation to hot lab facilities, it shall impede quick retrieval works. So in order to reduce the burden of transportation of fuel debris to hot lab facilities, abbreviated (in-situ) analysis technology shall be developed for prompt confirmation of the existence of fuel components as an adhesion to PCV structures or penetration into them. Regarding high radiation level samples or environment along with accumulation of knowledge and result of uranium qualitative analysis detection efficiency shall be improved, and for detection of fuel components for contamination countermeasures during measurement necessary sophistication shall take place. Considering combination with tools used in internal investigation, the abbreviated analysis devices for long time stable operation in the on-site environment affected by high radiation and humidity shall be sophisticated.

(2) Fuel debris release highly volatile cesium during melting, so it is difficult to apply the methods for estimation of fuel burn-up based on the gamma-ray from cesium. Due to this individual characteristics of fuel debris, there are concerns about unchanged application of non-destructive measurement methods used at reprocessing facilities etc. So measurement method shall be selected upon comprehensive judgement based on measurement confirmation tests using simulated fuel debris, simulation calculation, results of analysis sediments and adhesion, indicator nuclide properties etc. measurement systems feasibility shall be examined and effectiveness shall be evaluated. Creation of design for manufacturing of non-destructive measurement device aimed at on-site application shall start. In using the selected non-destructive measurement method, improvement of detection efficiency and accuracy, effect of container shape etc. shall be examined. Also, scenarios of non-destructive measurement and items of abbreviated screening shall be examined. Based on it, in case of construction of series of non-destructive measurement systems feasibility shall be examined and their effectiveness shall be evaluated. Creation of design for manufacturing of non-destructive measurement device aimed at on-site application shall start.

Definition of criterion for judgment on objective achievement

- Analytical evaluation of 1F fuel debris (FY2026)
- Preparation of state estimation figure in 3 dimensions CG (FY2026)
- Expansion of measurement results by abbreviated analytical methods (FY2026)
- Conceptual study of abbreviated screening (FY2026)
- improvement of detection efficiency in the chosen non-destructive measurement method (FY2026)

(Implementation schedule) B2③: Development of Analysis and Estimation Technology for Characterization of Fuel Debris



B3①: Development of Fuel Debris Retrieval Method (new)

Purpose

Towards scaling up retrieval of fuel debris and internal structures, development of elemental technology and tests necessary for retrieval method feasibility shall be conducted and on-site applicability shall be evaluated.

Implementation Content

○Since FY2024, based on proposals etc. regarding the selection of methods indicated in the Report of "Sub-committee for the evaluation of fuel debris retrieval methods", TEPCO is proceeding with detailed design considerations. In these considerations, technology necessary for the tasks related to feasibility of retrieval methods shall be developed.

○Among the tasks related to extracted feasibility in partial submersion method, technology shall be developed for continuous effective collection of granular fuel debris deposited at the bottom of PCV.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1.Development of Partial Submersion Method

(1) Development of technologies for continuous fuel debris collection

Technology shall be developed for continuous effective collection of granular fuel debris deposited at the bottom part of PCV. As a conceptual examination of continuous collection system, scenarios of fuel debris retrieval at the bottom of PCV and preconditions (distribution of fuel debris, characteristics and collection locations, PCV water level etc.) shall be organized, safety requirements and functions shall be examined, structure of continuous collection system shall be investigated, methods of removal of obstacles inside pedestal and methods of equipment placement, access routes, construction etc. shall be examined. Also, as a development of elemental technology for this system, collection methods, solid-liquid separation methods, methods of containing of separated fuel debris into collection vessel etc. shall be examined and verification by prototype shall be conducted. Finally, based on a result of systems' conceptual examination and development of elemental technology, on-site applicability of this technology development shall be evaluated.

(notes)

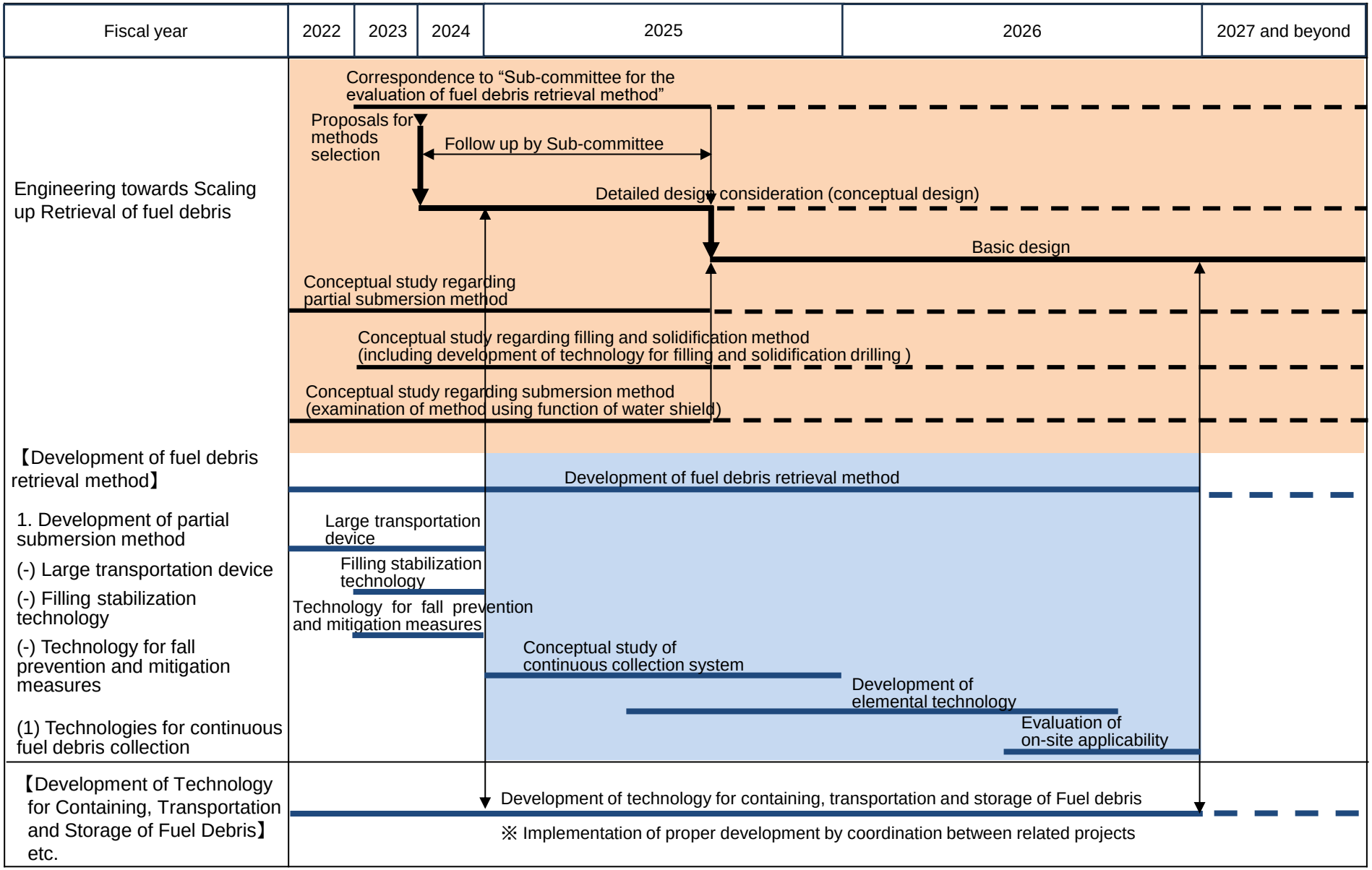
In the partial submersion method, development shall be implemented considering the following handling characteristics and maintenance methods:

- In principle, remote maintenance is required as devices are to be installed in high-dose areas.
- Consideration shall be given to contamination of the devices and necessary decontamination.
- The work areas for maintenance are limited.
- Waste generated by maintenance works shall be minimized as much as possible.
- Criticality monitoring devices shall be installed and handled with consideration.

Definition of criterion for judgment on objective achievement

- Conceptual examination of continuous collection system (FY2025)
- Development of elemental technology (FY2026)
- Evaluation of on-site applicability (FY2026)

(Implementation schedule) B3①: Development of Fuel Debris Retrieval Method (new)



B3②-2：Development of analytical technology for contamination monitoring (continued)

Purpose

Towards scaling up retrieval of fuel debris and internal structures, tests and elemental technology development necessary for ensuring of safety during works shall be conducted.

Implementation Content

○Retrieval of fuel debris is the work under the environment including uncertainty factors in addition to high radiation and high contamination. Methods of analysis towards scaling up retrieval of fuel debris shall be developed.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

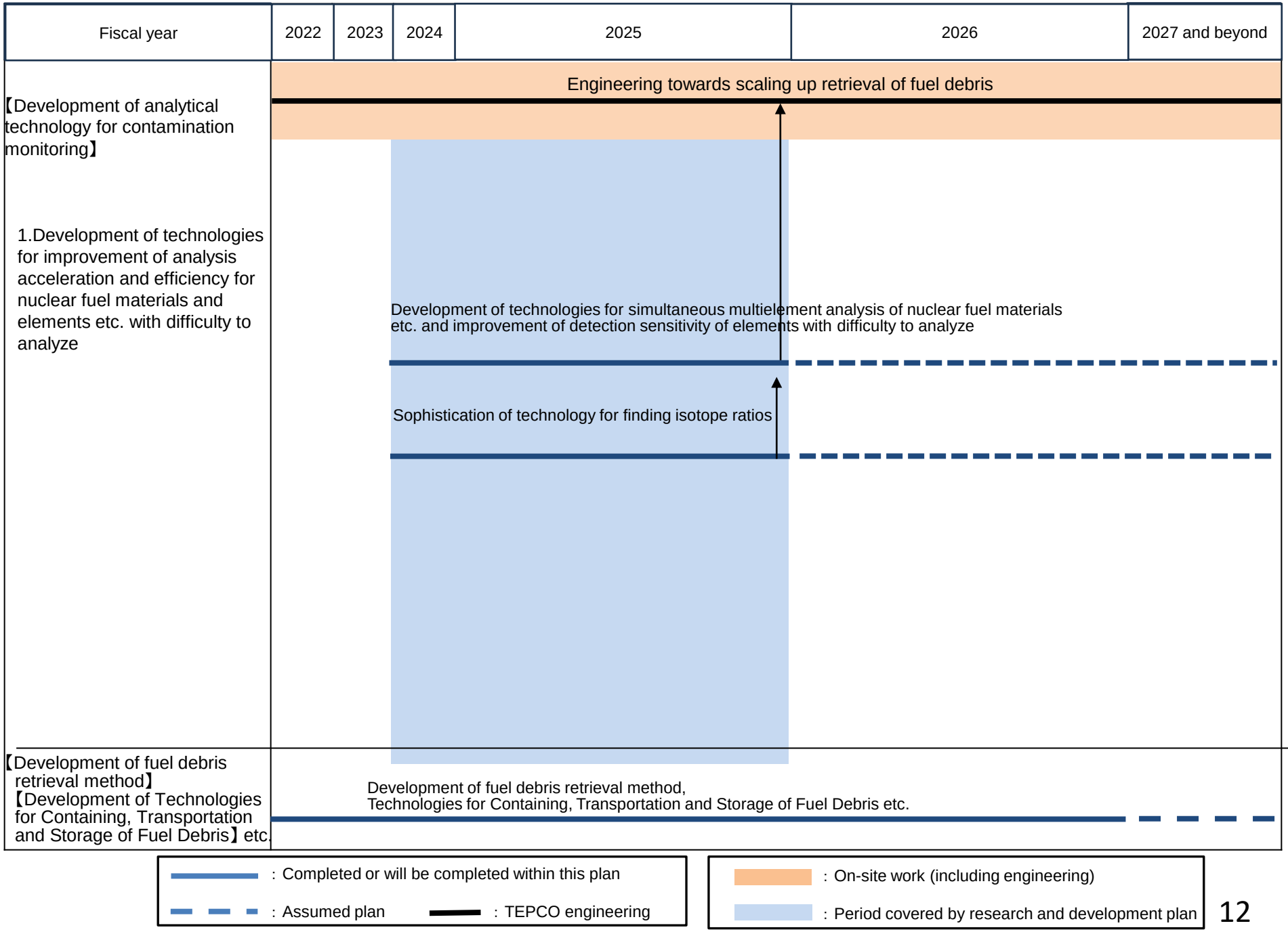
1. Development of technologies for improvement of analysis acceleration and efficiency for nuclear fuel materials and elements etc. with difficulty to analyze

When contacting with fuel debris, nuclear fuel materials and radioactive isotopes elute in circulating cooling water of liquid processing system and air radioactive substances following disintegration and chemical reactions also precipitate as solid bodies. And thus, it comes to nuclear fuel materials and radioactive isotopes adhesion and distribution of contamination in the wide area inside the building. In this situation with contamination, despite the fact that concentration level of nuclear fuel materials and radioactive isotopes is lower than that of fuel debris, the number of samples obtained for monitoring shall grow. As oxidation valence and chemical characteristics of each element are different, it is necessary to conduct complex preprocessing of precipitation, separation etc. dependent on each element. Also, regarding the samples with low radioactivity, there are cases when analysis is difficult because of low content of radioactive isotopes, many isobars etc. Hereafter, along with progress in decommissioning process number and types of samples to be analyzed shall grow. Therefore, throughout the whole analysis process including preprocessing, development of technologies for speeding up, automatization and labor saving, to improvement of efficiency of works related to analysis and rapid monitoring inside of the building are necessary. Specifically, simultaneous multielement analysis technology shall be developed for highly efficient separation and detection of nuclear fuel materials and radioactive isotopes as selected target from samples. In development of this technology accuracy control of isotope ratios and guaranteeing of quality of analysis are necessary so technology for finding isotope ratios shall be sophisticated.

Definition of criterion for judgment on objective achievement

- Evaluation of simultaneous multielement analysis of nuclear fuel materials etc. and methods of improvement for detection sensitivity of elements with difficulty to analyze(FY2025)

(Implementation schedule) B3②-2：Development of analytical technology for contamination monitoring



B3②-3：Development of Technologies for Impact Assessment due to Dust Dispersion (new)

Purpose

Towards scaling up retrieval of fuel debris, necessary for ensuring safety of retrieval works technology shall be developed for assessment of dust dispersion impact.

Implementation Content

○Regarding tests for acquisition of dust dispersion rate data assuming the environment during fuel debris processing, based on the results of the previous projects, data shall be enriched by tests assuming processing closer to real situation.

○For the purpose to grasp the Leak Pass Factor of dust migration into environment during fuel debris processing, tests shall be conducted to understand the dependence of dispersion impact parameters.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1.Development of technologies for impact assessment due to dust dispersion

① Implementation of Test on Dust Dispersion Rate Data Acquisition Assuming the Environment during Fuel Debris Processing

In FY2021・2022 (phase1) and FY2023・2024 (phase2) the dust dispersion rate data was systematically acquired regarding 5 methods (disk cutter, chiseling, core boring, laser, abrasive water jet), and factors affecting dust dispersion (dispersion rate, particle size distribution, processing defects, property values etc.) were analyzed by parametric test for each method. Also, in order to complement test results to transition rate, simulation analyses (CFD) have been performed and basic dust dispersion effects such as differences in dry/wet conditions have been organized.

In this project, regarding factors affecting dust dispersion which were grasped in previous phases, data related to on-site conditions and methods shall be obtained and expanded. Regarding cold materials and uranium-containing simulated debris tests shall be conducted in the environment (wet condition) assuming processing close to reality.

Regarding mechanical processing of uranium-containing simulated debris, based on the results of implementation in dry conditions in previous phases, data of wet conditions shall be obtained.

In addition, laser processing test (in dry conditions) shall be conducted as a thermal processing of uranium-containing simulated debris. The purpose is to understand the effects of thermal processing to heterogeneous compositions. Fuel debris contain a heterogeneous mixture of heavy actinide nuclides such as uranium and volatile FP nuclides such as cesium, so the heterogeneous composition test pieces able to simulate it shall be used. Besides, as laser processing is also expected to be used underwater, underwater processing tests (in wet conditions) using cold materials shall be conducted to examine the phenomena of aggregation and others which are generated before dust is released into the gas phase.

With these effects of different environment conditions (dry/wet conditions) and composition conditions (hot/cold test pieces) on dust dispersion rate shall be evaluated.

② Implementation of Tests to Understand the Impact on the Leak Pass Factor of Dust During Fuel Debris Processing

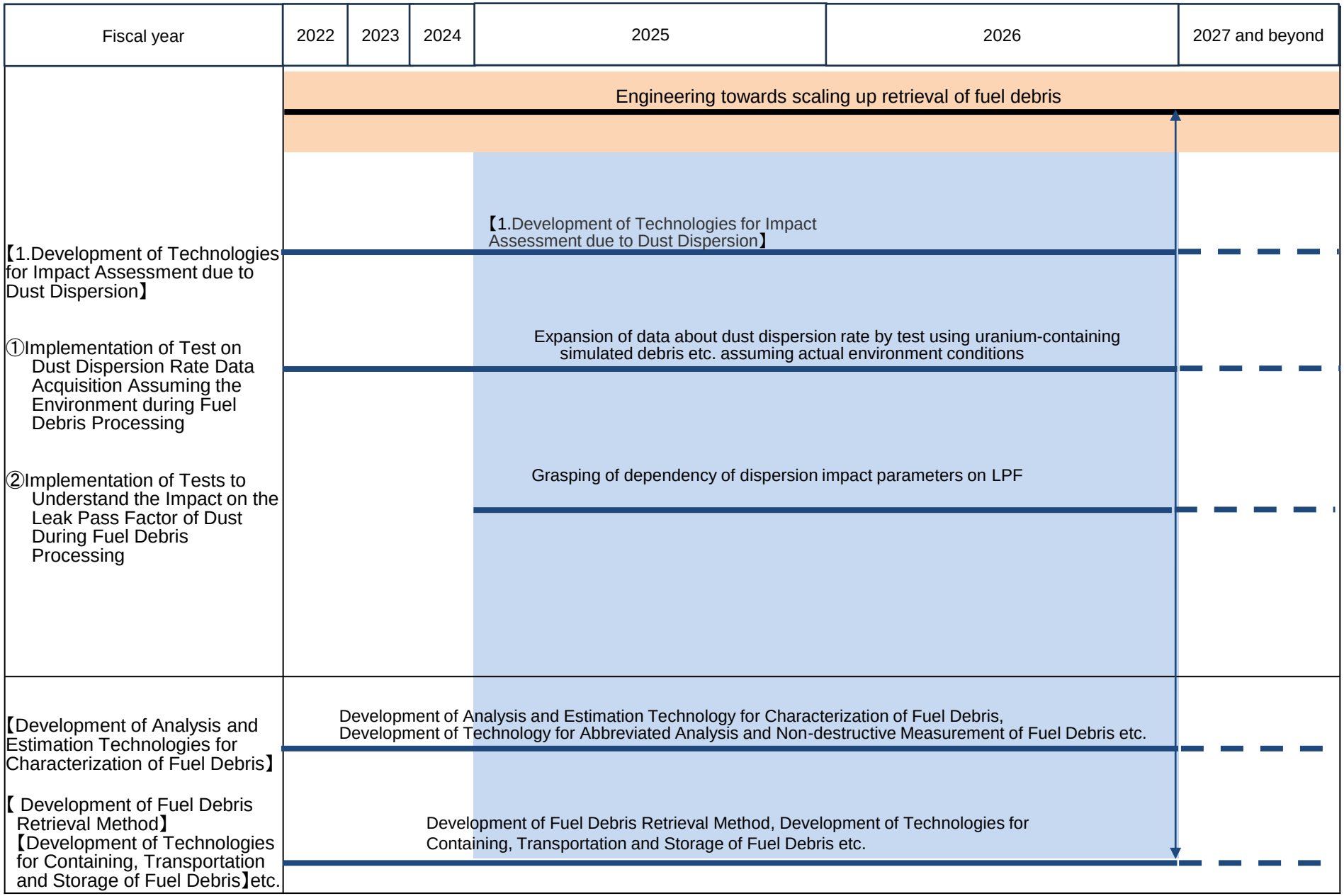
It is necessary to understand the Leak Pass Factor(LPF) which represents the removal effect along the migration path from the dust generation point to its release into the environment. With relatively small systems used in previous phases, LPF cannot be verified as phenomena (gravitational settling, particle size growth, etc.) in large spaces such as those found in field conditions. Therefore, in this project, the behavior of dust shall be grasped by using several meter sizes (large size) horizontal and vertical testing equipment able to confirm the phenomena involved in the dust migration process. To assess the impact of dispersion parameters such as those identified in the dust dispersion rate data acquisition tests from the previous phases, a wet environment and other conditions shall be set up and representative processing methods shall be selected from mechanical processing and thermal processing, and data on LPF of the generated dust shall be obtained.

Through these efforts, the dependence of dispersion impact parameters on LPF shall be evaluated.

Definition of criterion for judgment on objective achievement

- Expansion of data about dust dispersion rate by test using uranium-containing simulated debris etc. assuming actual environment conditions (FY2026)
- Grasping of dependence of dispersion impact parameters on LPF (FY2026)

(Implementation schedule) B3②-3：Development of Technologies for Impact Assessment due to Dust Dispersion



B3②-4：Technology Development of Analytical Method for Exposure Dose Evaluation (new)

Purpose

Towards scaling up retrieval of fuel debris and internal structures, the elemental technologies to ensure safety during these operations shall be developed and conducted the tests.

Implementation Content

○ Retrieval of fuel debris is a task that is carried out under high radiation and high contamination conditions and also involves uncertainties of environmental conditions, so it is necessary to evaluate internal exposure dose sufficiently accurately and rapidity. Towards scaling up retrieval of fuel debris, in order to be enable to apply on-site, investigation, examination, testing on methods and instruments related to technologies for measuring and evaluating body surface contamination and analytical method for exposure dose evaluation shall be developed.

○This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1.Technology development for analytical method for exposure dose evaluation

In decommissioning operations, it is necessary to monitor large number of operators for a variety of nuclides. As methods for sufficiently accurate and rapid evaluation of internal exposure dose, until now following measures have been carried out: organization of system for comprehensive evaluation of internal exposure dose using bioassay and in vitro measurements (lung monitoring etc.) and technical development related to appropriate standards, accelerating bioassay processes, measuring and evaluating body contamination, and development to improve accuracy of sampling measurement by a filter paper, etc.

To address the risk of internal exposure due to intake α- and β-nuclides during decommissioning work including fuel debris retrieval etc., based on the results so far, an internal exposure dose evaluation program shall be developed through the following technological advancements:

(1) Technology Development for Measuring and Evaluating Internal Exposure Dose

Bioassay technologies, such as method of analysis of α nuclides to deal with the situation with a large number of operators intaking radioactivity shall be developed.

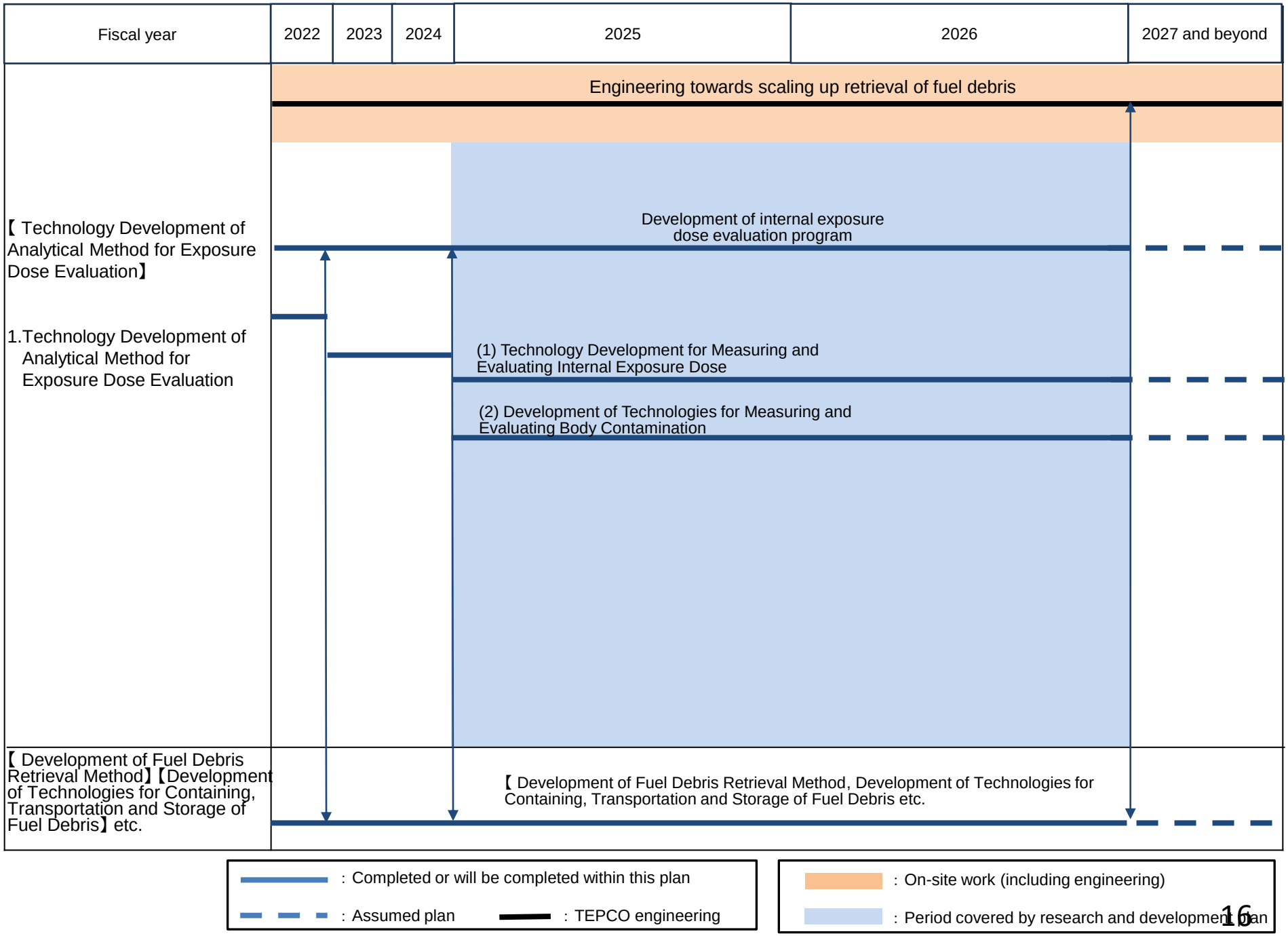
(2) Development of Technologies for Measuring and Evaluating Body Contamination

Specifications for handheld skin β-contamination detectors shall be optimized and measurement technologies in mixed α- and β-radiation environments to improve the evaluation accuracy of skin contamination shall be developed. Also, technologies for accelerating α-contamination detection on the body and ensuring reliable detection in hard-to-measure areas shall be developed.

Definition of criterion for judgment on objective achievement

- Verification and evaluation of bioassay technologies to address situations where a large number of individuals experience internal radiation intake. (FY2026)
- Verification and evaluation of detecting instruments to improve the evaluation accuracy of skin contanimation (FY2026)
- Verification and evaluation of technologies for accelerating α-contamination detection on the body and ensuring reliable detection (FY2026)

(Implementation schedule) B3②-4：Technology Development of Analytical Method for Exposure Dose Evaluation



B3④：Development of Technology for Containing, Transportation and Storage of Fuel Debris (new)

Purpose

In order to establish a scenario for the process from fuel debris retrieval to its storage, system shall be developed for safe, secure and reasonable containment, transportation and storage of retrieved fuel debris.

Implementation Content

○ Technology shall be developed for construction of the system which can handle various forms of collection (lump-shaped, granular ~ powdery, slurry/sludge state) of fuel debris with heterogeneous composition, and make possible stable storage after safe, secure and reasonable containment and transportation, considering the hydrogen gas that may be generated by radiolysis of coexisting water and the criticality of nuclear fuel materials. Furthermore, the development shall be conducted in coordination with related projects.

○ This research and development shall reflect operators' point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1. Development of technology for handling of powdery and slurry/sludge state fuel debris

(1) Advancement of Prediction Method of Hydrogen Generation

・In addition to evaluation of hydrogen gas amount generated by γ and proton rays which was confirmed by FY 2024, considering factors affecting hydrogen gas amount generated, hydrogen gas amount generated by α rays shall be confirmed by testing. Also, it is considered that the effect of α and β radiation on hydrogen gas generation is expected to be relatively larger for powdery or slurry/sludge state fuel debris than for granular or lump-shaped ones. Using the hydrogen gas generation prediction methods for each radiation type at single irradiation field, estimates shall be made for the amount of hydrogen gas generated under irradiation conditions where α-, β-, and γ-radiation are combined. From these results, the contribution of each radiation type shall be evaluated.

(2) Establishment of countermeasures for hydrogen gas accumulation based on hydrogen gas release behavior

・Generation of hydrogen gas accumulation under assumed conditions was confirmed by elemental tests by FY 2024. For solution of tasks arising from these results elemental tests (evaluation of effects of water quality such as pH, particle size distribution, slurry/sludge height etc.) shall be implemented. Based on achieved additional results, the need for measures against hydrogen gas accumulation and their content shall be examined.

2. Technology development for maintaining the stable storage of fuel debris

・It is important to maintain integrity of containment boundaries for safe storage of fuel debris. In order to examine the necessity of monitoring corrosion in storage containers, the environmental conditions inside fuel debris storage container shall be estimated and based on it, corrosion occurrence and progression models shall be examined, and preparation for its verification shall be made. It also shall be used for selection of future container materials and examination of the necessity of additional measures for surface treatments etc. In addition, the necessity of monitoring of other items besides corrosion shall also be examined.

3. Re-evaluation of storage methods and storage canisters

・Based on the results of mentioned above 1., 2. the results of previous examination of storage methods and storage canisters shall be re-evaluated.

※Projects for development of related technologies

"Development of Fuel Debris Retrieval Method", "Development of Technologies for Impact Assessment due to Dust Dispersion", "Research and Development of Processing and Disposal of Solid Waste".

Definition of criterion for judgment on objective achievement

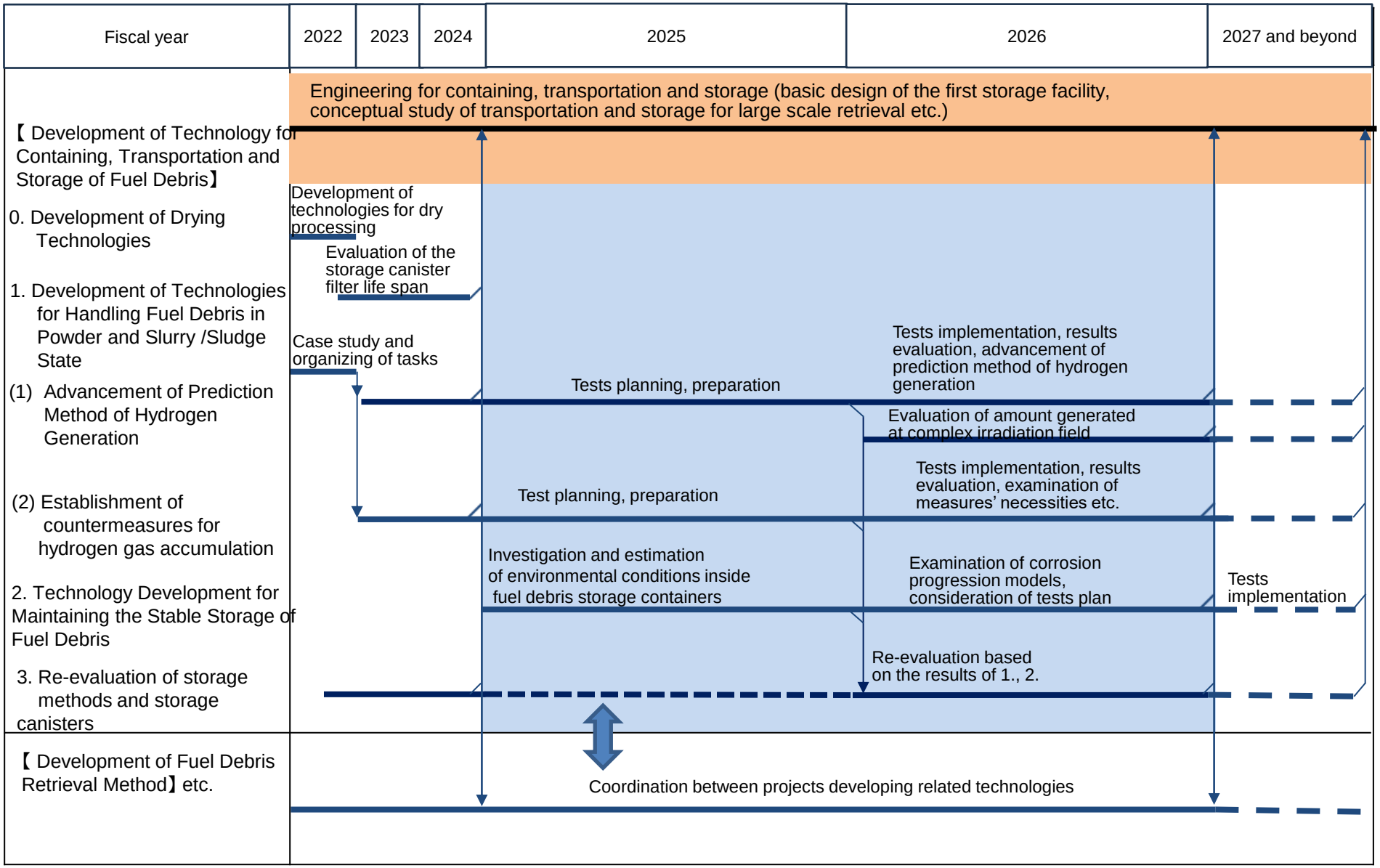
・ Completion of planning and preparation of tests for prediction method of hydrogen gas generation and hydrogen gas release behavior (FY2025)

・Start of consideration aimed at evaluation of situation inside of storage container, extraction of factors to accelerate corrosion and preparation of corrosion progression models (FY2025)

・Examination and narrow down of container materials and candidate measures for surface treatments etc. (FY2025)

・Re-evaluation of storage methods and storage canisters (FY2026)

(Implementation schedule) B3④: Development of Technology for Containing, Transportation and Storage of Fuel Debris



: Completed or will be completed within this plan
: Assumed plan
: TEPCO engineering
: On-site work (including engineering)
: Period covered by research and development plan

B3⑤：Development of Assistive Technologies for Integration Management of Decommissioning of the Fukushima Daiichi Nuclear Power Station (continued)

Purpose

Technologies related to the assistive system necessary for smooth integration management of decommissioning of the Fukushima Daiichi NPS (1F) including scaling up retrieval of fuel debris and internal structures shall be developed.

Implementation Content

○ Assistive system for integration management is an information management system which enables accurate and quick on-site response by long-term and continuous monitoring of environmental changes during the fuel debris retrieval period, and also by integrating and sharing the acquired monitoring data and operation data, including those on trouble experiences, so the technology development using digital technologies is necessary. Therefore, the technical requirements necessary for system construction shall be clarified by “study of overall concept of assistive system for integration management", and then “development of technologies for integration management using digital technologies” shall be implemented.

○ This research and development shall reflect operators’ point of view and the results of this research shall be used in the engineering conducted by the operating entity.

1. Study of overall concept of assistive system for integration management

It is important to share various information obtained at each stage, such as “scaling up retrieval of fuel debris” etc., and to proceed retrieval of fuel debris with the priority on ensuring safety based on the unified understanding. For that purpose, it is necessary to integrate the information into easily recognizable means and to develop the systems that support data management, operation, etc.. In order to efficiently proceed with decommissioning of 1F, it is considered effective to introduce digital technology which shall integrate and share information at every stage of design, development, installation, operation etc. in addition to monitoring information.

Regarding data management and utilization method corresponding to the stages of fuel debris retrieval from preparation to operation, the requirements for the system for monitoring and control of the entire operation shall be put in order, and overall concept of integration management assistive system shall be considered. Also, together with clarifying the ideal state of database management system necessary for assistive system for integration management, technical requirements necessary for system construction shall be put in order.

As it is important to dig deeper based on investigated now “Scenario of fuel debris retrieval”, this study shall be continued in FY2025 as TEPCO project.

2. Development of technologies for integration management using digital technologies

・Construction of database management system for fuel debris retrieval

In assistive system for integration management, assistive subsystems responding to various tasks necessary for 1F decommissioning such as works plan, remote operation, status monitoring, equipment maintenance etc., and platform integrating these subsystems shall be necessary. In order to process, convert, and use efficiently and effectively huge amount of information/data collected by various assistive subsystems, it is important to develop database management system including data platform which enables integration and sharing of quick information using digital technology.

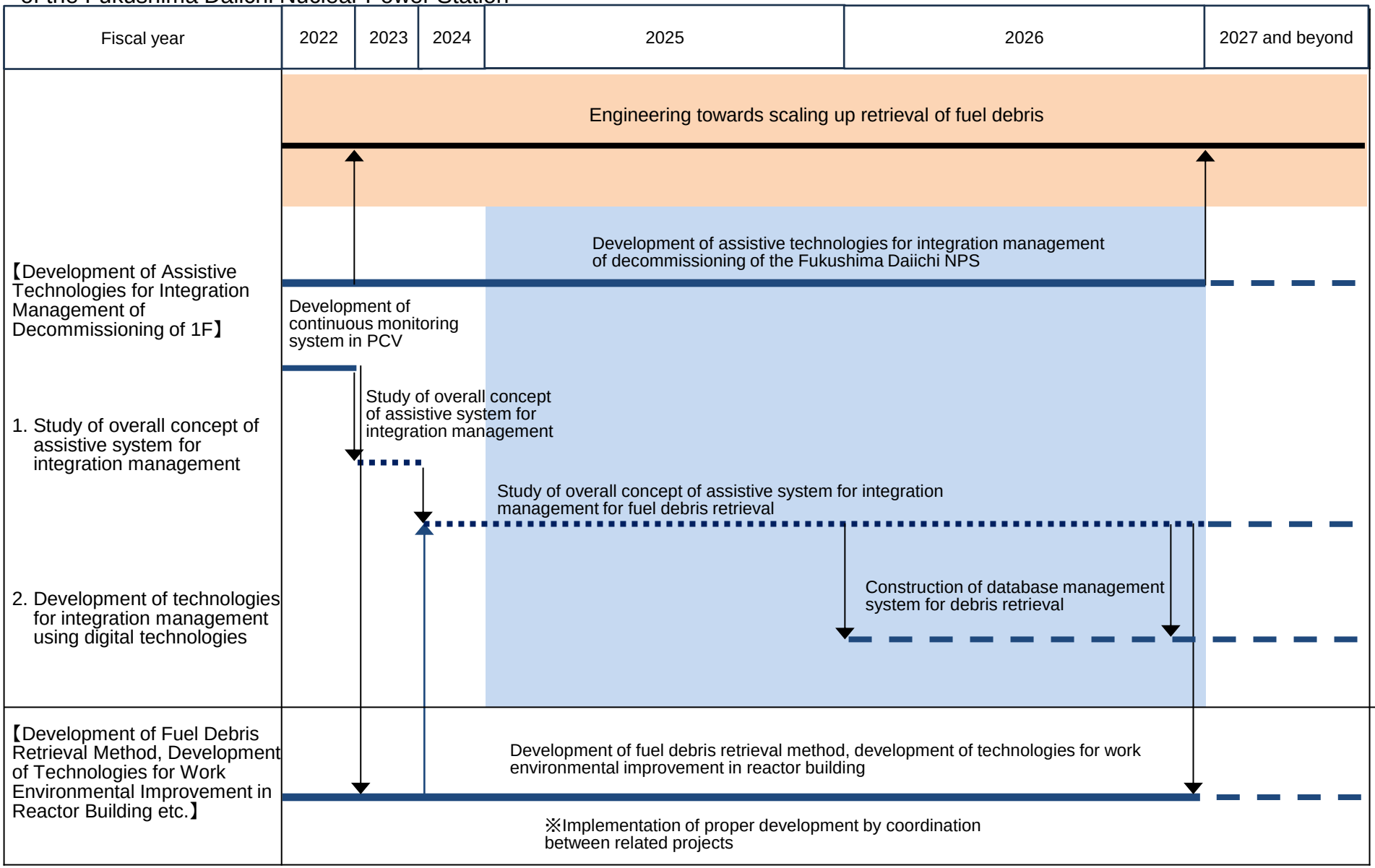
Study and investigation shall be conducted regarding database concept including configuration of data platform for database operation, data management according to its usage, data sharing for its rational classification and usage and ensuring security etc., and also issues to provide necessary functions and practical use shall be extracted and development plan shall be formulated.

After the development elements regarding “technology for integration management using digital technology” are extracted in “1. Study of overall concept of assistive system for integration management”, this development items shall be put in order, and subsidy project of this development shall be planned from FY2026 and beyond.

Definition of criterion for judgment on objective achievement

・Based on results of ‘study of overall concept of assistive system for integration management’ , the indicators shall be set up.

(Implementation schedule) B3⑤: Development of Assistive Technologies for Integration Management of Decommissioning of the Fukushima Daiichi Nuclear Power Station



C：Research and Development of Processing and Disposal of Solid Waste (1/3) (continued, partially new)

Purpose

Considering the prospects of processing and disposal method and technology related to its safety, as provided in FY2021, in order to form waste streams suitable for the characteristics of solid wastes[*1], proceeding the progress of waste characterization, it shall be conducted to develop, compare, and evaluate storage/management, processing, recycling and disposal options and planned to investigate towards presenting the appropriate measures for the practical solid waste overall management (management from solid waste generation up to its recycling and disposal)

Implementation Content（Overview）

Ⅰ. In order to reflect in overall solid waste management, acquisition and management of analysis data shall be conducted and activities for enhancement of efficiency of waste characterization shall be proceeded.

Ⅱ. For safe and reasonable storage/management, the technology for reduction and recycling in order to reduce the amount of waste shall be developed.

Ⅲ. Technology related to processing and disposal shall be developed to obtain necessary technical knowledge for constructing of waste stream. Regarding processing technology, an investigation shall be conducted on issues related to the applicability of normal-temperature processing, the stability of the solidified waste manufactured by various processing technologies, the interim processing technology contributing to expanding the range of application of the normal-temperature processing technology, and flexible and reasonable processing technology. Regarding disposal technology, the proposal of disposal concept options shall be established and presented, as well as critical scenarios affecting safety functions of a repository are identified to assess its safety, and technologies to assess its safety corresponding to the scenarios are developed.

The results of this research and development shall be used in the engineering conducted by the operating entity.

Ⅰ. Waste characterization

1. Acquisition and management of analysis data, etc.

Considering waste analysis plan by TEPCO for fulfillment of storage/ management, nuclides to analyze according to waste classification and necessary accuracy required for the analytical purpose shall be investigated, and the annual analysis plan shall be formulated. According to the annual analysis plan, analysis data shall be obtained, evaluated and managed, etc.

Regarding the analysis of C-14, I-129, etc. which are difficult to analysis and important for safety assessment of disposal, the analysis data shall be obtained after the investigation of pretreatment method etc. based on the chemical form. Regarding the adsorbents collected from the actual cesium adsorption towers, pretreatment and analytical methods, etc. shall be investigated, and analysis data shall be obtained. For a non-destructive measurement system based on γ-ray measuring for waste generated during fuel debris retrieval, a concept of this system shall be established.

2. Enhancement of Efficiency on Waste Characterization

In order to contribute to the proposal of the analysis plan, it shall be proceeded the trial of the analysis planning method that combines Data Quality Objectives (DQO) process[*2] with Bayesian statistic, and the applied cases of this method shall be accumulated. A collection of case studies of the analytical planning method based on those results shall be formulated and updated appropriately. The statistical inventory estimation method which development proceeded so far shall be investigated to apply to main stored wastes and target of future dismantling facilities etc. Estimated results shall be provided for development of processing and disposal technology, etc.

Ⅱ. Storage/management

In order to improve the estimation accuracy of radioactivity inventory for contaminated metals (melting of contaminated metals with radioactive materials), the contamination estimation model etc. shall be improved. In addition, radioactive concentration data of actual wastes shall be obtained, and the results evaluated by the improved model etc. shall be validated.

Migration rates data of nuclides that can be important nuclides shall be expanded through melting tests, and reliabilities of nuclides migration rates data shall be improved. Also, evaluation method for nuclides migration behavior shall be investigated through thermodynamic equilibrium calculations. Reflecting the investigation results etc. from these melting tests and thermodynamic equilibrium calculations, nuclide migration rates during melting processing shall be evaluated. Methods for selection of nuclides that can be important nuclides in clearance inspection shall be examined and these nuclides shall be selected. In addition, the grounds for the selection shall be summarized.

The proposal of method to determine radioactive concentration shall be examined by method measuring radiation dose of selected nuclides that can be important nuclides. Also, for contaminated metals an analysis plan (proposal) using an analytical planning method that combines the DQO process and Bayesian statistics shall be examined. Reasonable and accelerated analytical methods that can be used for clearance inspection shall be developed.

*1 Solid waste: Include rubbles and water treatment secondary waste after the accident and radioactive solid waste stored at Fukushima Daiichi Nuclear Power Plant before the accident.

*2 DQO process: A method to plan analytical sampling for decision makings developed by U.S. Environmental Protection Agency.

C：Research and Development of Processing and Disposal of Solid Waste (2/3) (continued, partially new)

Ⅲ. Processing and disposal

1. Processing technology

In order to identify the range of chemical compositions, etc. that can be solidified by normal-temperature processing technologies (cement solidification, AAM solidification), there shall be evaluated the impacts of major components assumed to affect the physical properties of solidified wastes targeted ALPS slurries, etc. Also, it shall be investigated if they contain multiple components. Regarding screening methods to determine the possibility of solidification using normal-temperature processing technology, in order to improve the processing capabilities, investigation shall be conducted for automation of series of evaluation.

In order to identify the physical property values of the solidified wastes necessary for disposal safety assessment, characteristics of solidified waste shall be evaluated by normal-temperature processing. For the evaluation of solidified waste long-term stability, survey of the long-term alteration behavior by acceleration tests and investigation regarding changes of the amorphous phase shall be conducted. In addition, regarding the stability of carbonate slurry, there shall be investigated the changes due to the changes of chemical compositions caused by heating, pressurization, phosphorylation etc. Regarding normal-temperature processing for full-scale (200L scale), based on the evaluation results for carbonate slurry by FY2024, examination of the applicability evaluation shall be conducted including also iron coprecipitation slurry.

For interim processing, regarding assumed tasks for practical use of pyrolysis processing, its impact shall be evaluated and countermeasures shall be examined. Also, for the waste where effectiveness of application for pyrolysis processing is not high, alternative measures shall be investigated. Bulk solidification technology for rubbles etc. difficult to segregate and glass melting processing technology for the dehydrated slurry together with a container were examined as flexible and reasonable processing technology. Regarding those technologies, their applicability of full-scale processing shall be evaluated based on the results obtained so far.

2. Disposal technology

① Presentation of the proposal of disposal concept options

Utilizing the survey results by FY2023 of information and knowledge necessary to present disposal concept, from all targeted waste there shall be selected the waste according to the priority of investigation of waste stream, and proposal shall be presented regarding its disposal concept options. In this regard, the information and knowledge necessary for disposal concept requirements plan and its sufficiency shall be put in order.

② Improvement of reliability of safety assessment technology for solid waste disposal

Utilizing the achievement by FY2023 such as survey results about disposal concept and safety assessment in Japan and overseas, storyboards etc., in order to evaluate the safety of disposal concept options presented in ①, important scenario affecting safety functions of the disposal site shall be extracted, and technology able to evaluate safety corresponding to those scenarios shall be developed.

C：Research and Development of Processing and Disposal of Solid Waste (3/3) (continued, partially new)

Definition of criterion for judgment on objective achievement

Ⅰ. Waste characterization

- Formulation of annual analysis plan and accumulation of obtained analysis data and sample information in the database (FY2025)
- Presentation of the concept of the non-destructive measurement system for waste generated during fuel debris retrieval and the results of analysis of the nuclides difficult to measure (C-14, I-129) (FY2025)
- Presentation of the investigation results of pretreatment and analytical methods for the adsorbents collected from the actual cesium adsorption tower (FY2025)
- Setting-in-order typical examples of analytical planning methods combining DQO process and Bayesian statistics, preparation of case study collection (FY2024), update (FY2025)
- Presentation of the results of stored waste inventory estimation (FY2025)

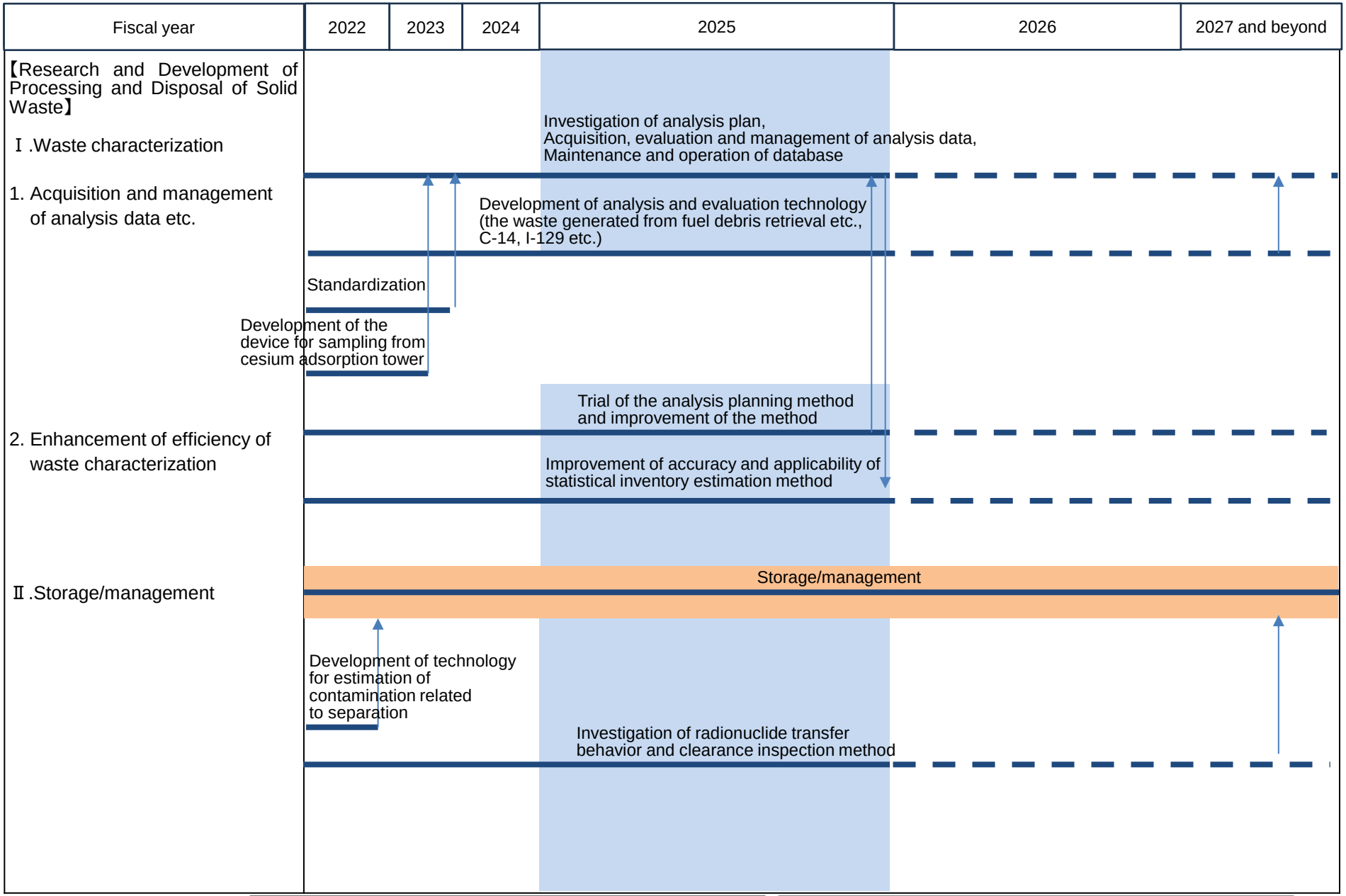
Ⅱ. Storage/management

- Improvement of analytical inventory estimation method for contaminated metals (FY2025)
- Assessment results of migration rates data during melting based on the investigation results of melting tests and thermodynamic equilibrium calculations (FY2025)
- Results of selection of nuclides that can be important nuclides during clearance inspection, the summary of the grounds for this selection and the results of development of analytical methods that can be used for inspection (FY2025)

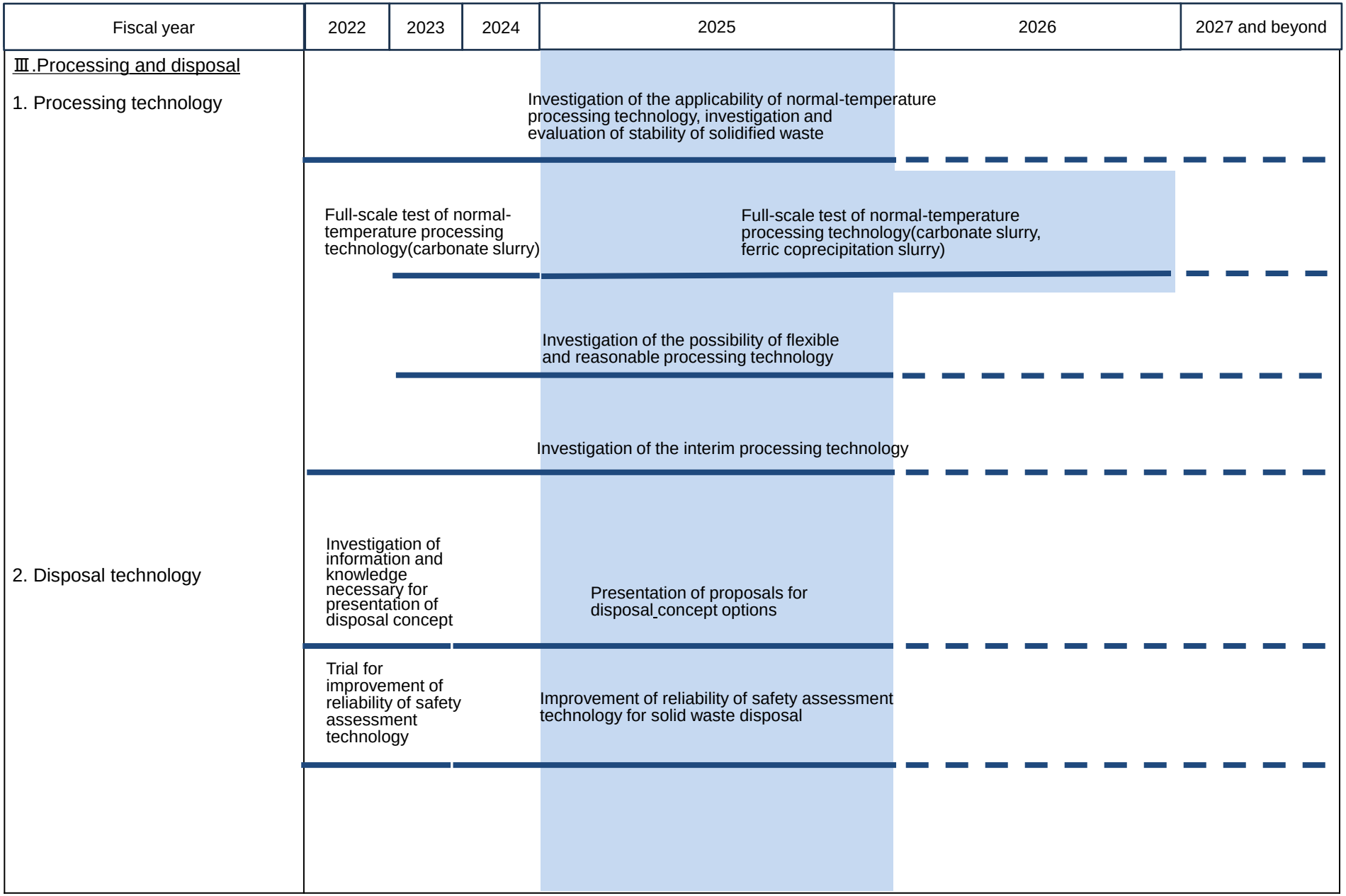
Ⅲ. Processing and disposal

- Results of impact evaluation for assumed materials affecting physical properties of solidified waste in normal-temperature processing (FY2025)
- Results of investigation related to automation of screening methods to determine the possibility of normal--temperature solidification (FY2025)
- Obtained results of the characteristics values of the solidified waste by normal-temperature processing (FY2025)
- Results of examination of solidified waste long-term stability by normal--temperature processing (FY2025)
- Evaluation results of the applicability of normal-temperature processing of carbonate and ferric coprecipitation slurry for full-scale processing (FY2026)
- Results of investigation regarding measures for the assumed problems for practical use of pyrolysis processing, and results of examination of alternative measures for the waste where application of pyrolysis processing is not effective (FY2025)
- Results of bulk glass melting solidification tests for rubbles etc. (FY2025)
- Results of glass melting processing tests for the dehydrated carbonate slurry together with a container (FY2025)
- Presentation of the proposal of disposal concept options for the selected wastes (FY2025)
- Extraction of important scenarios corresponding to the proposal of disposal concept options, development of the model that can be installed the important scenarios, setting up of evaluation parameters (FY2025)

(Implementation schedule) C：Research and Development of Processing and Disposal of Solid Waste (1/2)



(Implementation schedule) C：Research and Development of Processing and Disposal of Solid Waste (2/2)



R&D Mid-and-Long-term Plan
- Major Processes and Approach to Major R&D Activities for Decommissioning [Fuel Debris Retrieval] of the Fukushima Daiichi NPS of TEPCO -

FY: 2023 | 2024 | 2025 | 2026 | 2029 | 2035～

Key Milestones

- Phase 2 — **Start of debris retrieval at the first implementing unit**
- Phase 3-(1) — **Gradual expansion of retrieval scale**
- (Next phase) — **Further expansion of the retrieval scale**

Legends :
- Main Processes (Described based on TEPCO DAP 2024, etc.)
- Practical application development and Applied research
- Basic/fundamental research (Major studies on debris retrieval)
- Key Technical issues ( )
- → : **Where R&D results are applied**
- → : **Linkage between main processes**

[A] Trial retrieval/ Gradual expansion of fuel debris retrieval (Unit 2)

［1］Trial retrieval at Unit 2

Improvement of the environment inside the buildings

Trial retrieval (internal investigations and fuel debris sampling*), Characterization of fuel debris

Manufacturing, testing*1 and installation of retrieval devices
Operational change of the safety systems, Removal of obstacles in openings, etc.

*1: Performed at Naraha Center for Remote Control Technology Development

Development of technology for detailed PCV internal investigations

［2］Gradual expansion of retrieval scale at Unit 2

Improvement of the environment inside the buildings

Fuel debris retrieval facility/Safety system/Fuel debris temporary storage facility/Maintenance faci

Design, manufacturing and testing (Performed at the Naraha Center for Remote Control Technology Development) — Installation

Technological development for gradual expansion of retrieval scale

Technical issues for gradual expansion of fuel debris retrieval
① Manufacturing equipment for gradual expansion of fuel debris retrieval
② Preparing storage facilities for fuel debris/waste
③ Study on criticality control technique

Fuel debris retrieval (Gradual expansion of scale)
Operation of storage facility for fuel debris
Operation of maintenance equipment
→ To fuel debris characterization

Recommendations for selecting retrieval methods
"Sub-Committee for the Evaluationof fuel debris retrieval methods"

Study the research and development issues for the method of retrieving fuel debris
【Special Task】

Identification of development issues
- Ⓐ Embodying collaboration on basic fundamental research into practical applications
- Ⓑ Embodying technological development required for engineering
- Continuous efforts

: Workflow

Research and development to be undertaken at an early stage

- Safety system ［Ⓐ-1Rationalization of criticality response］［Ⓐ-2Development of technology for removing colloidal α - nuclides ］
- Collecting/transfer/storage ［Ⓐ-3 Development of technology for stable storage of fuel debris］
- Internal investigation ［Ⓑ-1Downsizing of the RPV investigation method via top access］
- Analysis technique ［Ⓑ-2 Non-destructive measurement technique for fuel debris］
- Retrieval method ［Ⓑ-3 Development of technologies for continuous fuel debris collection］［Ⓑ-4 Development of technology for drilling with solidification/fill］
- Collecting/transfer/storage ［Ⓑ-5 Monitoring techniques for safe storage of fuel debris］

［1］Environmental improvement

Environmental improvement inside and outside the Unit 1 buildings — Inside the buildings: Radiation dose reduction/Removal of obstacles, etc. Outside the buildings: Removal of SGTS piping/lower part of exhaust stacks at Units 1/2, and transformers, etc. => Securing space *2

Environmental improvement inside and outside the Unit 3 buildings — Inside the buildings: PCV water level lowering/Radiation dose reduction, etc. Outside the buildings: Removal of exhaust stacks and transformers at Units 3/4, Improvement of the basement floor, etc. => Securing space *2

*2: Added buildings, maintenance buildings, storage buildings

Development of technology for environmental improvement inside/outside reactor buildings
Development of assessment methods for deterioration status, etc., of building frames and equipment

Lowering the PCV water level achieved

Research to visualize the distribution of radioactive materials and contribute to the reduction of radiation exposure
Research on the relationship between radiation and corrosion and material degradation

→ Target : - Improvement of a system for work planning to reduce radiation exposure
- Establishment of measures and evaluation methods considering the effects of corrosion on long-term integrity

［2］PCV/RPV internal investigations, Characterization of fuel debris

Unit 3 PCV internal investigations (with drones, etc.) → to characterization of fuel debris

Investigation of reactor well /RPV internal investigation by accessing from the top at Unit 3

RPV internal investigation by accessing from the bottom at Unit 3 → To the retrieval equipment design

Development of RPV internal investigation technology ［Ⓑ-1Downsizing of the RPV investigation method via top access］

Development of technology for RPV preliminary internal investigation (with existing piping)

Unit 3 RPV preliminary internal investigation
(The investigation using the instrumentation piping of Unit 2 is part of gradual expansion of the retrieval scale..)

Characterization of fuel debris

Development of analytical technology for fuel debris characterization ［Ⓑ-2 Non-destructive assey technique for fuel debris］

Demonstration of analytical technology (Utilization of radioactive material analysis and research facilities)

Fuel debris measurement technique with LIBS

Examples of development of practical applications for basic and fundamental research results

Research on analytical evaluation methods for retrieved fuel debris, including non-destructive measurement
Research on the advancement of analytical techniques for radioactive material and nuclear fuel materialc

→ Target : - Establishment of analytical evaluation method including non-destructive measurement, and methods for radioactive waste sorting and inventory evaluation
- Establishment of remote/in-situ/rapid analysis technique

Advanced estimation of the situation in the PCV

Estimation of in-core conditions and research on accident events by analyzing and evaluating fuel debris

→ Target : - Grasping of in-core situation and refinement of understanding of FP behavior in the PCV based on on-site knowledge and actual debris data

[B] Further expansion of the retrieval scale (Unit

［3］Retrieval equipment, safety systems, maintenance equipment, and storage facility *3

*3: Main processes for proceeding with the study on Unit 3 as a preceding case

Reflecting the results of Trial retrieval (Internal investigation / fuel debris sampling)

Reflecting findings obtained after the start of a gradual scale expansion

Conceptual study 1 | Conceptual study 2 | Design of retrieval installations | Manufacturing, installation and testing of retrieval equipment/training facility and fuel debris retrieval [cutting/recovery] [sorting/storing] [transfer/custody]

Study of safety systems/maintenance methods | Design of safety system / maintenance installations | Manufacturing, installation and testing of safety systems/ maintenance installations

Development of technologies toward further expansion of fuel debris and in-core structure retrieval
①Development of fuel debris retrieval methods ②Development of safety system
③Development of safety assessment technology ④Development of remote control device maintenance technique

Stabilisation technique with geopolimer

Research on safety assurance during fuel debris retrieval and storage
Research to visualize the distribution of radioactive materials and contribute to the reduction of radiation exposure

→ Target : - Eestablishment of effective evaluation methods for ensuring safety during long-term in-core residency and after retrieval
- Improvement of a system for work planning to reduce radiation exposure

Technical issues toward further expansion of the retrieval scale

①Development of fuel debris retrieval methods (realization of removal concept, machining/collecting techniques)
Development of equipment installed on the upper part of the operating floor such as large transportation device etc.,Development of technology for stabilizing in-core filler,
Ⓑ-3 Development of technologies for continuous fuel debris collection, Ⓑ-4 Development of technology for drilling with solidification/fill
②Development of safety systems (liquid system/gas system and criticality control)
Ⓐ-1Rationalization of criticality response, Ⓐ-2Development of technology for removing colloidal α - nuclides, Development of technologies for rapid and efficient analysis of nuclear fuel materials and difficult-to-analyze elements, etc.
③Development of safety assessment technology
Acquisition of dust dispersion data during fuel debris cutting and technology development of analytical method for exposure dose evaluation
④Development of technologies for maintaining remote equipment Development of decontamination and maintenance technologies for contaminated remote equipment

Design of fuel debris storage facilities | Construction/installation of facility | Trial operation, Start of operation

Development of technologies for containing, transportation and storage of fuel debris ［Ⓑ-5Monitoring techniques for safe storage of fuel debris］

Research on safety assurance during fuel debris retrievaland storage ［Ⓐ-3Development of technology for stable storage of fuel debris］

→ Target : - Establish safety and risk assessment methods for storing fuel debris

Development of support technology for integrated management of the decommissioning of Fukushima Daiichi

R&D Mid-and-Long-term Plan
- Major Processes and Approach to Major R&D Activities for Decommissioning [Fuel Debris Retrieval] of the Fukushima Daiichi NPS of TEPCO -

FY	2023	2024	2025	2026	2029	2035～
Key Milestones	Phase 2		Phase 3-(1)		(Next phase)	
	Start of debris retrieval at the first implementing unit				**Gradual expansion of retrieval scale**	**Further expansion of the retrieval scale**

[C] Waste Management

［1］Characterization

- Characterization
- Acquisition and maagement of analysis data, etc.
- Improvement of efficiency in characterization

Technical issues for characterization
① Development of analysis plan/acquisition, evaluation and management of analysis data ② Operation and improvement of convenience of analysis and sample database
③ Development and measurement of analytical techniques for analytically difficult and disposal important nuclides
④ Development and measurement of analysis technology for adsorbents collected from actual equipment of cesium sorption vesseels ⑤Development of nondestructive

The rerated issues and needs are taken up in the processing/disposal fields of tghe over all map of basic and fundamental research, and implemented as basic fundamental research.

［2］Storage/management

- Storage/management
- Research on waste reduction through reuse

［3］Processing/disposal

- Development of processing technology
- Development of disposal technology
- Study on waste stream

Technical issues for processing/disposal
①Development of low-temperature processing technology ②Evaluation of stability of solidified waste
③Development of intermediate processing technology ④Disposal concept option proposal
⑤Improvement of reliability of safety assessment technology for solid waste disposal, etc.

The rerated issues and needs are taken up in the processing/disposal fields of tghe over all map of basic and fundamental research, and implemented as basic fundamental research.

In reviewing the R&D Mid-and-Long-term plan, TEPCO, MEXT, METI and NDF have discussed the required results, timing needed and implementing structures through the R&D planning meetings. The plan is being prepared by incorporating basic/fundamental research into practical application development and applied research, such as the Project of Decommissioning and Contaminated water/Treated water, as an integral part.