The outline of Japan Atomic Energy Agency's Okuma Analysis and Research Center (1)

- The total progress of Labolatory-1 and Labolatory-2 -

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Japan Atomic Energy Agency (JAEA)

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1. Back Ground

◇ **JAEA works on various missions for decommissioning on the 1F plant.**

JAEA / Sector of Fukushima Research and Development Organization

○Fukushima Administrative Department (clerical work) ;(49)

○Fukushima Management Department (builder work) ;(17)

◎**Collaborative Laboratories for Advanced Decommissioning Science ; (134)**

(International Collaborative Research Building @ Tomioka March, 2017 - **)**

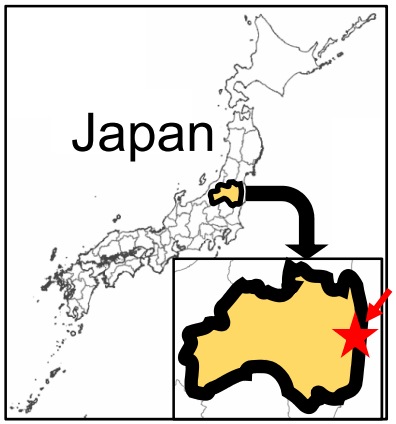
◎**Naraha Remote Technology Development Center ; (35)** April, 2016 -

◎**Okuma Facilities Management Department ; (98)**

>**Installation Design Section (20 members)**

>**Safety Design Section (7 members)**

◎**Fukushima Environmental Safety Center; 151 members**



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(International Collaborative Research Building)

Naraha Remote Technology Development Center

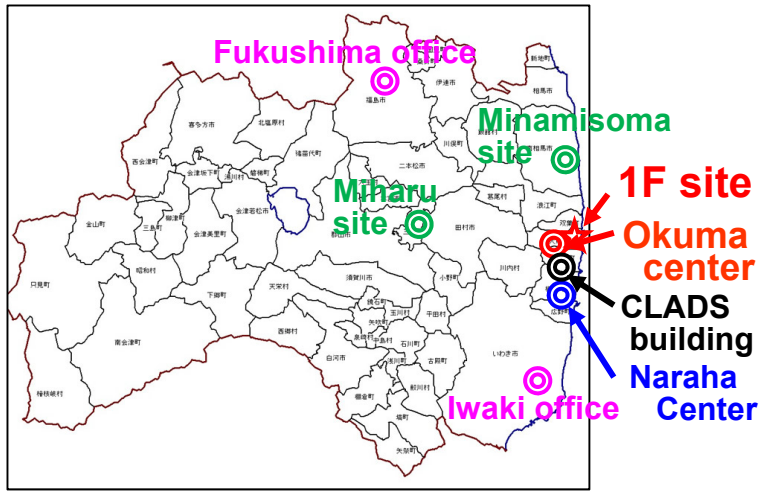
Center of Excellence

For the decommissioning of 1F site

Okuma Analysis and Research Center

JAEA (PIE facility) ⇔ IRID/TEPCO (analysis items)

Sector of Fukushima Research and Development



Fukushima Prefecture

(1st August 2017, members : involved combine post and detachment members, https://fukushima.jaea.go.jp/english/information/organization.html)

2. Concept of Okuma Analysis and Research Center（Basic Concept）

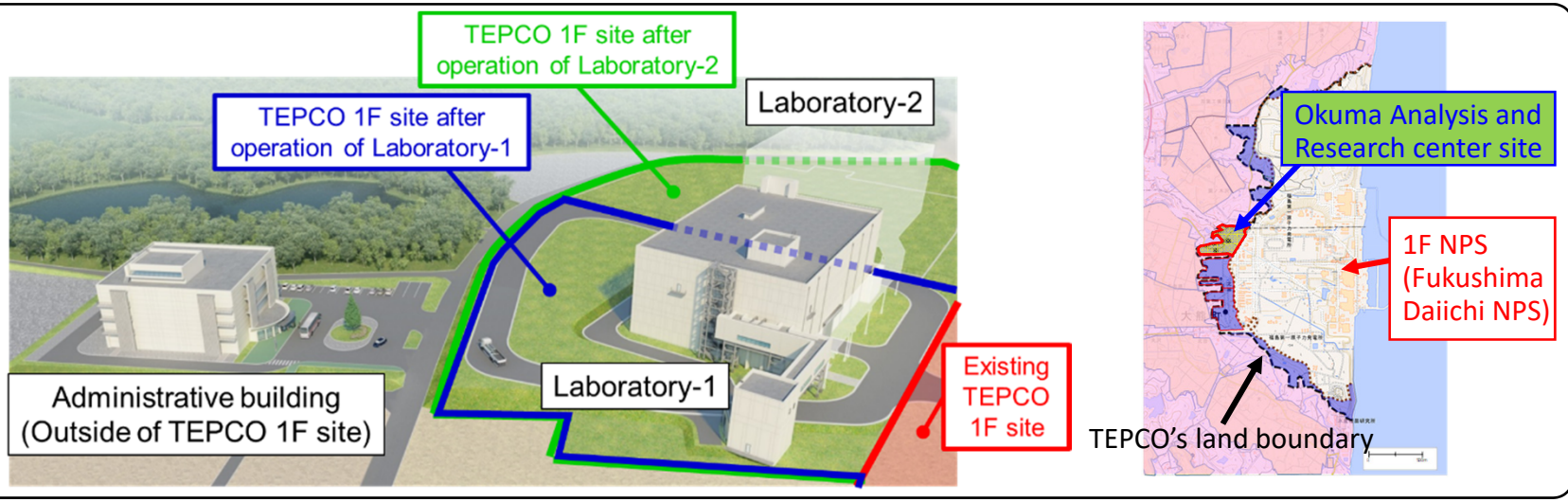
◇ Okuma Analysis and Research Center consists of three buildings near the 1F site.

(1) Administrative building

・Consists of Office room, Workshop for mock-up testing

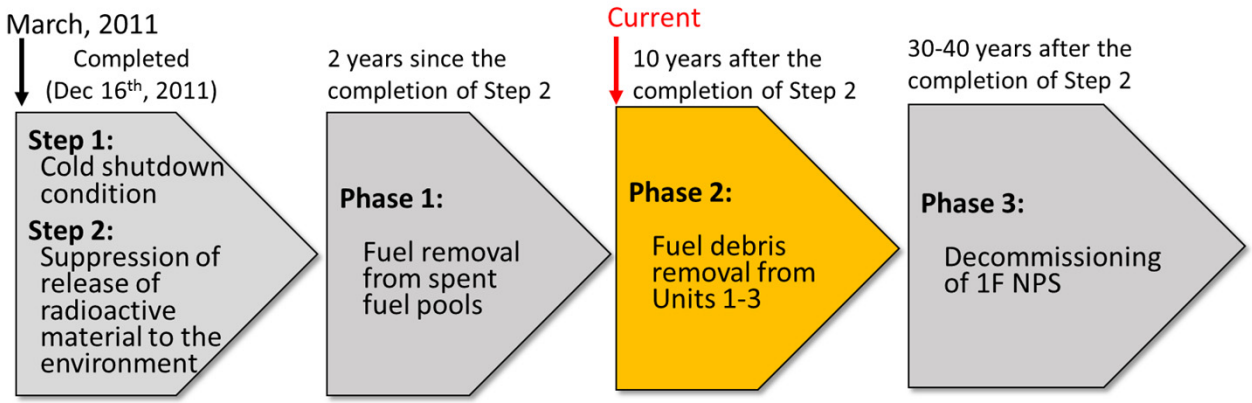
(2) Laboratory-1, (3) Laboratory-2 : hot laboratory

	Analysis Specimens			
	Target	Level	Surface dose rate	Weight
Laboratory-1	Radioactive materials	Low	Under 1 mSv/h	Under 300 kg
		Medium	Under 1 Sv/h	Under 2 kg
Laboratory-2 (TBD)		High	Over 1 Sv/h(TBD)	Under 200 g (TBD)
	Fuel debris	—	—	Under 5 kg (TBD)

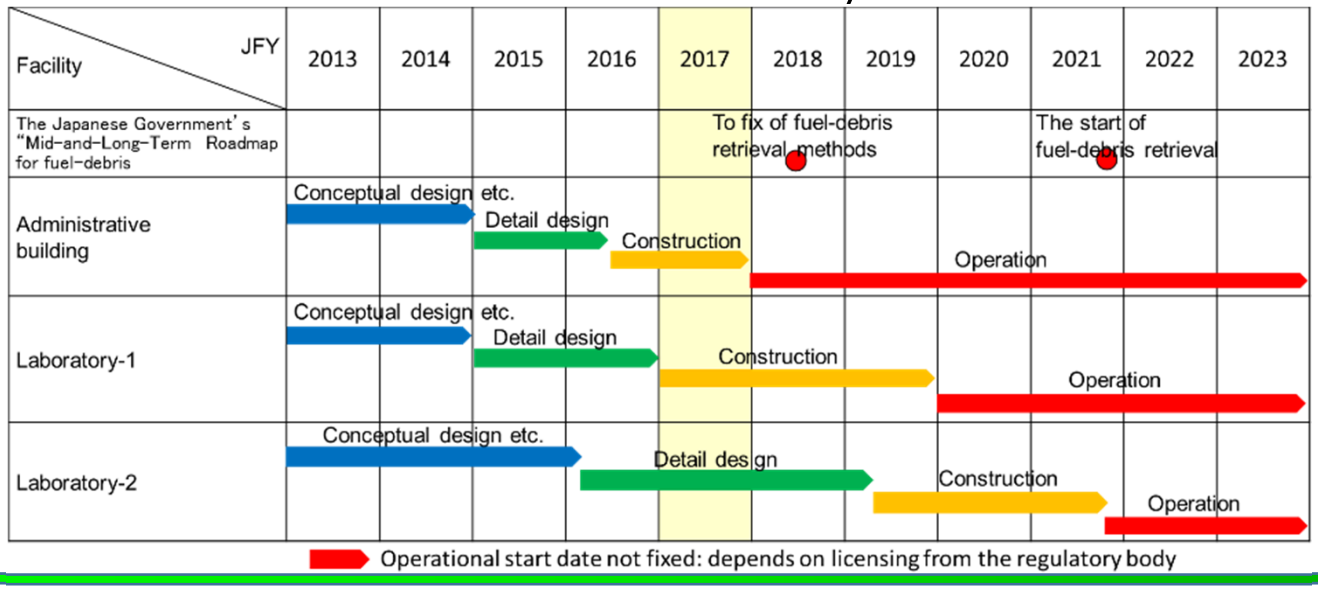


2. Concept of Okuma Analysis and Research Center (Construction Schedule)

◇ Mid-and-ling-Term Roadmap for decommissioning of 1F NPS



◇ Construction schedule of Okuma Analysis and Research Center



3. Details of Okuma Center (Design of main analysis items)

◇ Okuma Analysis and Research Center consists of three buildings

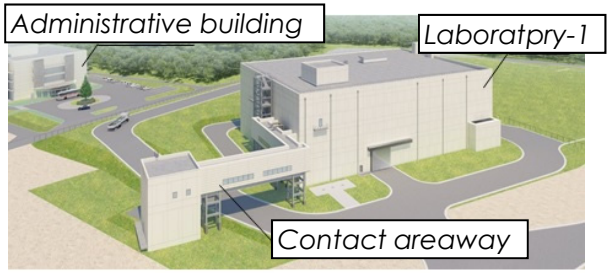
	Administrative building	Laboratory-1	Laboratory-2 (Detail is TBD)
Building design	4 floors	3 floors	4 floors
Total floor area	4,786m^2	9,671m^2	9,200m^2
Analysis materials	- (Researcher's Residential and Office room)	・Rubble and Secondary wastes (low and middle levels; under 1Sv/h)	・Fuel debris ・High level radioactive rubble and secondary wastes (over 1sv/h)
	—	β-γ specimen	α-γ specimen
	—	200 samples/year	12 samples/year (Fuel debris) 50 samples/year (highly contaminated material)
Main equipment	Workshop Meeting room	Steel cell : 4 Glove Box : 10 Fume hood : 56	Concrete cell : 14 Steel cell : 12 Glove Box : 25 Fume hood : 8
Main Analysis items	—	Radioactivity : α, γ, β-ray spectrometer Chemical analysis : ICP-AES, ICP-MS, Ion-chromatograph, Total-organic carbon analyzer Surface analysis : SEM/EDS, Digital mico-scope Physical analysis : Density, Thermal property, Hardness ,and so on	Radioactivity : α, γ, β-ray spectrometer Chemical analysis : ICP-AES, ICP-MS, Ion-chromatograph, Total organic-carbon analyzer, GC-MS Surface analysis : EPMA/WDS, SEM/EDS, XRD, XRF, Digital Microscope Physical analysis : Density, Thermal Property, Hardness , and so on

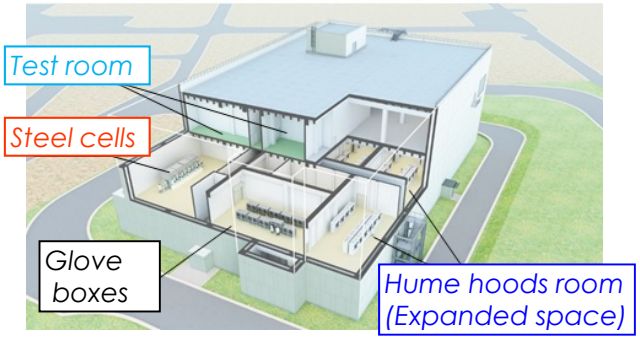
Same equipment

3. Details of Okuma Center (Topics of Administrative building Laboratory-1)

◇ Okuma Analysis and Research Center

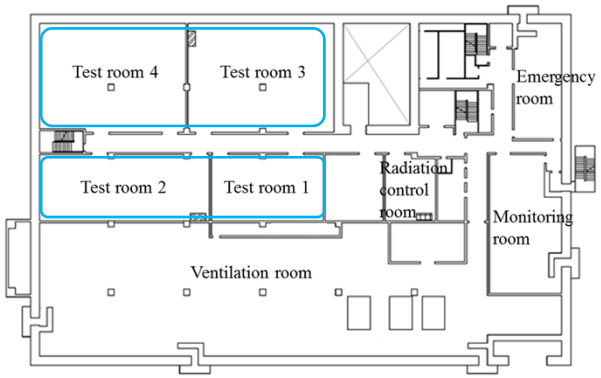
(1) Administrative building (2) Laboratory-1 (3) Laboratory-2



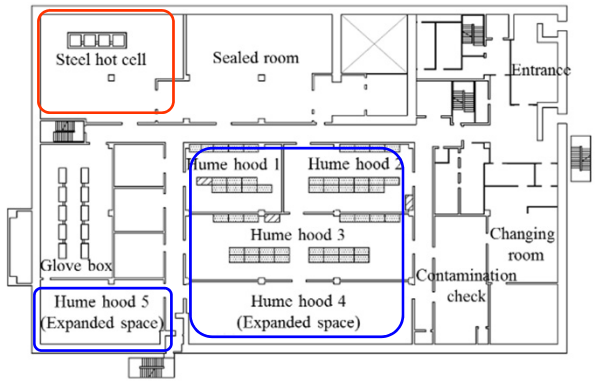


Administrative building *Laboratory-1*

(https://fukushima.jaea.go.jp/initiatives/cat05/haishi07.html)

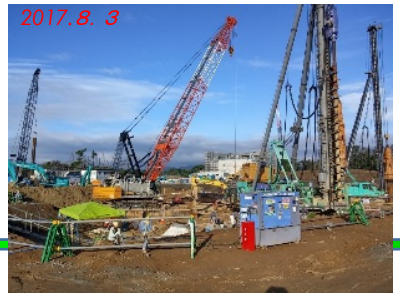


Schematic layout of Laboratory-1 (third floor plan).



Schematic layout of Laboratory-1 (second floor plan).

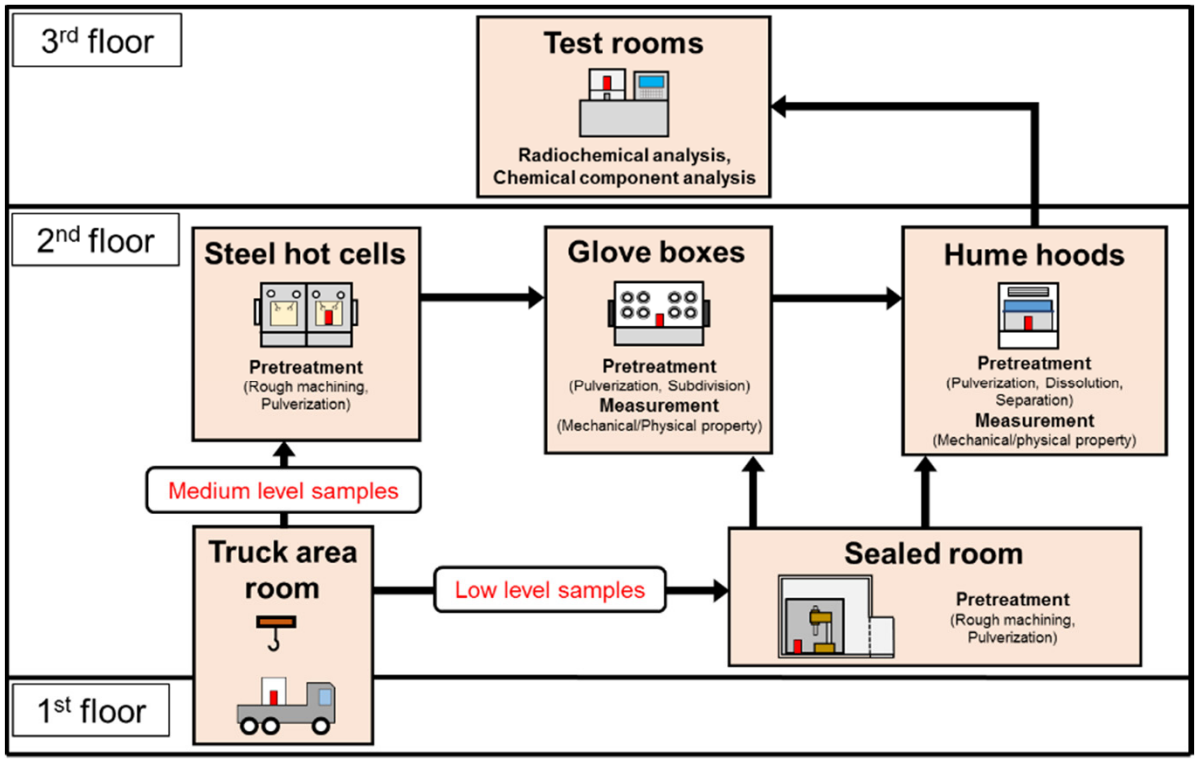
Progress status of administrative building.



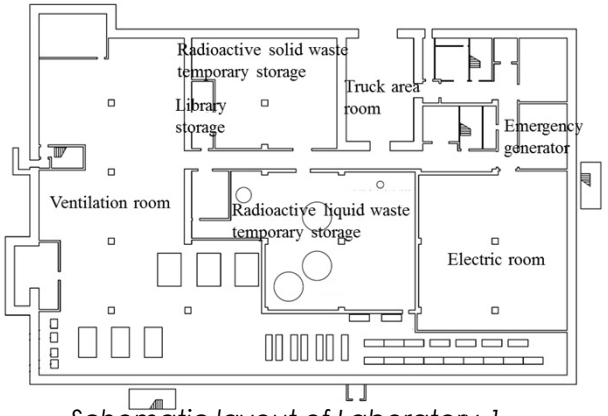
Progress status of Laboratory-1.

3. Details of Okuma Center (Topics of Laboratory-1 (2/2))

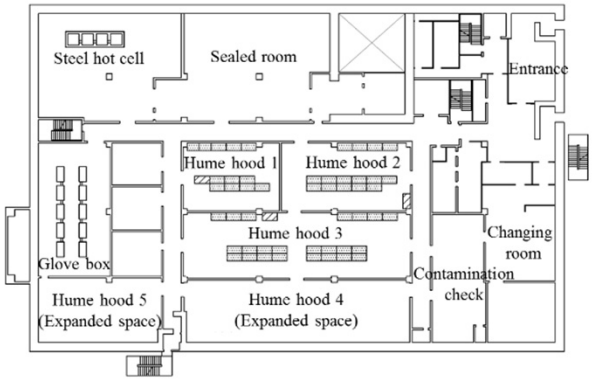
◇ Okuma Analysis and Research Center
(1) Administrative building **(2) Laboratory-1** (3) Laboratory-2



Analytical flow chart in Laboratory-1



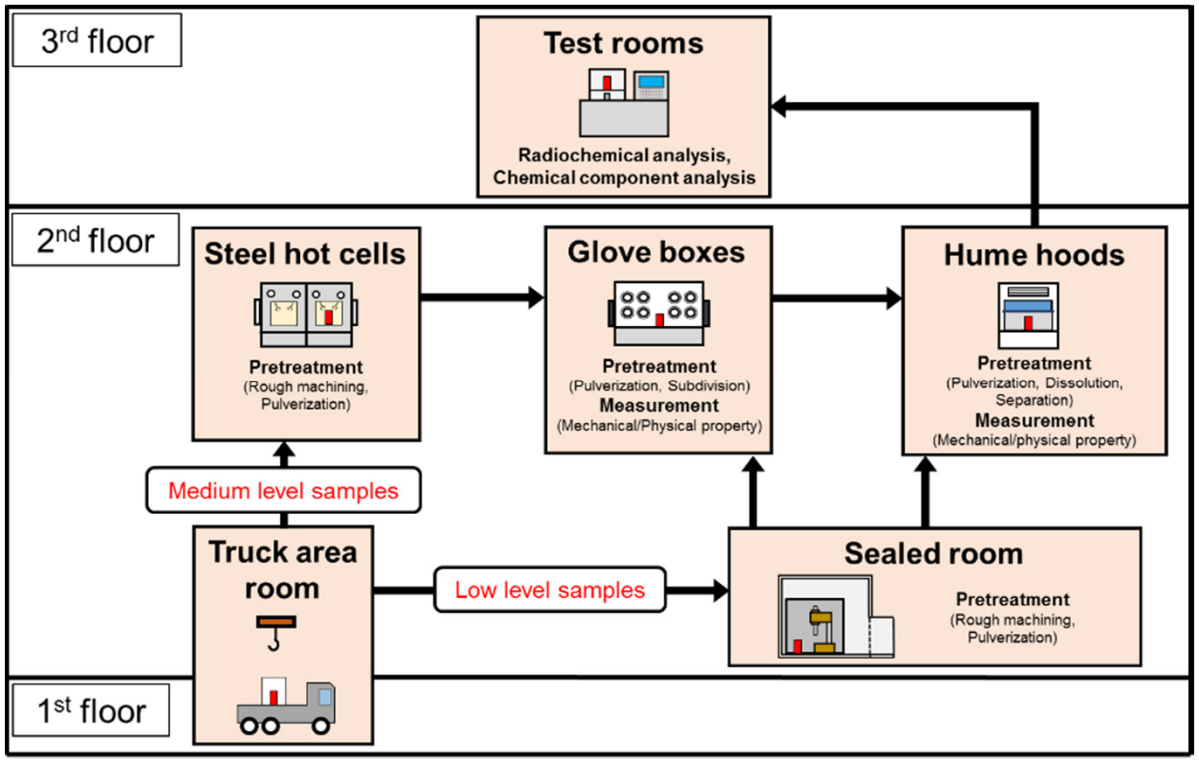
Schematic layout of Laboratory-1 (first floor).



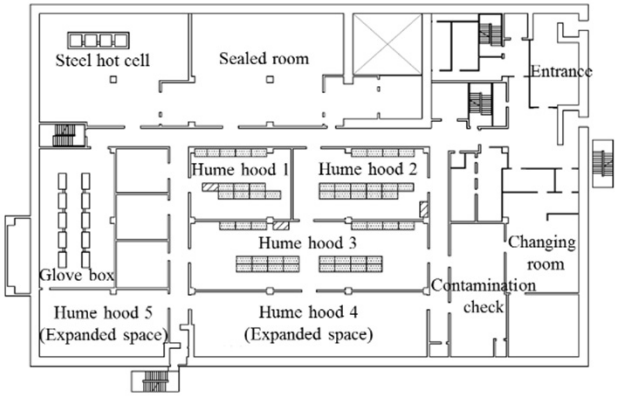
Schematic layout of Laboratory-1 (second floor).

3. Details of Okuma Center (Topics of Laboratory-1 (2/2))

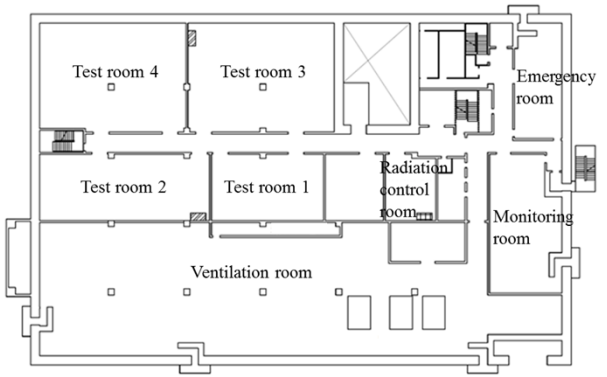
◇ Okuma Analysis and Research Center
(1) Administrative building **(2) Laboratory-1** (3) Laboratory-2



Analytical flow chart in Laboratory-1



Schematic layout of Laboratory-1 (second floor).



Schematic layout of Laboratory-1 (third floor).

3. Details of Okuma Center (Topics of Laboratory-2 (1/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

➢ Analysis times (TBD)
- For the analysis of the storage management and decommissioning of the fuel debris and radioactive waste, many analysis items required by IRID/TEPCO.

Analysis request item list (1/2)

Characteristics			Equipment
Basic property	Morphorogy (powder/particle/mass)		EPMA/WDS, SEM/EDS, XRD, Digital Microscope
	Diometry (diameter)		BET, Laser diffraction particle counter, Sieving machine
	Density	Density	Densimeter, X-ray CT
		Porosity	Optical microscope, X-ray CT
	Composition	U / Pu content SUS mixed ratio	TIMS, α spectrometer, Titrator, ICP-MS, XRF, ICP-AES
		B4C mixed ratio	ICP-AES
		Gd mixed ratio	XRF, ICP-AES
		U enrichment	α spectrometer, ICP-MS
		Salt concentration	AAS, Ion chromatography, Total organic carbon meter
		FP, CP, Actinide content	XRF, ICP-MS
	Inventory		α, β, γ-ray spectrometer, γ-camera, Gas flow meter, Liquid scintillation counter

3. Details of Okuma Center (Topics of Laboratory-2 (2/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

Analysis request item list (2/2)

Characteristics			Equipment
Basic property	Chemical form, Surface analysis		SEM-WDS, XRD, EPMA/EDX, Optical microscope, Digital Microscope.
	Moisture content		Karl fischer moisture titrator.
	Hydrogen concentration		Gas chromatography.
Mechanical strength	Hardness	Vickers	Micro vickers hardness meter.
	Fracture toughness	IF method	Micro vickers hardness meter.
	Compression		Micro vickers hardness meter.
Thermal property	Thermal conductivity		Laser flash thermal diffusivity measurement device.
	Thermal behaviour		TG-DTA.
	Thermal expansion		Thermal expansion meter.
	Melting point		Melting temperature measurement device.
Radiation Property	Dose rate		Calculation from inventory analysis.
	Calorific value		Calculation from inventory analysis.
Other	Hydrogen production, **and all that**		Gas chromatography.

3. Details of Okuma Center (Topics of Laboratory-2 (3/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

➢ For Analysis times (TBD)
・Many analysis items required in IRID/TEPCO. But Laboratory-2 limited in installation space. It is difficult to install all analysis equipment.

➢ In 2016, JAEA convened the expert meeting for selected the basic analysis equipment installed in laboratory-2.
・A standard for selection
(1) The significance of analysis items (Standard analysis items)
(2) The timing of analysis phase (reflecting on removal method of debris)

・Main Conclusion
(1) Selected the main analysis items (activity, element analysis, hardness, etc)
(2) Added the SEM/EDS and XRF for the simple analysis at receiving.
(3) Thermal equipment will be installed in medium phase.
(4) For the future request, Keeping the backup and maintenance space.

3. Details of Okuma Center (Topics of Laboratory-2 (3/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

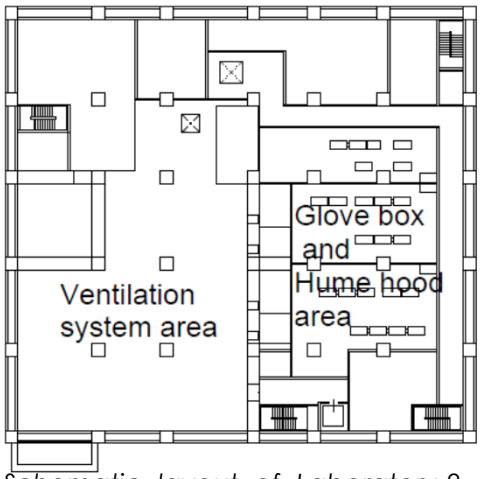
Selected analysis candidate item list ※ Only installed in Lab-2

Characteristics		Equipment (Laboratory-2, TBD)
Basic property	Morphorogy (powder/particle/mass)	EPMA/WDS, SEM/EDS, XRD, Digital Microscope
	Diometry (diameter)	Digital Microscope
	Density	Densimeter, X-ray CT
	Composition (U / Pu content, SUS mixed ratio, B4C mixed ratio, Gd mixed ratio, U enrichment, Salt concentration, FP, CP, Actinide content)	α spectrometer, ICP-MS, XRF, ICP-AES
		ICP-AES
		XRF, ICP-AES
		α spectrometer, ICP-MS
		Ion chromatography, Total organic carbon meter
		XRF, ICP-MS
	Inventory	α, β, γ-ray spectrometer, γ-camera, Gas flow meter, Liquid scintillation counter
	Chemical form, Surface analysis	SEM-EDS, XRD, EPMA/WDS, Optical microscope, Digital Microscope.
	Moisture content	Karl fischer moisture titrator
	Hydrogen concentration	Gas chromatography
Mechanical strength	Vickers Hardness	Micro Vickers hardness meter
	Fracture toughness (IF method)	
Radiation Property	Dose rate	Calculation from inventory analysis
	Calorific value	
Other	Hydrogen production	Gas chromatography.

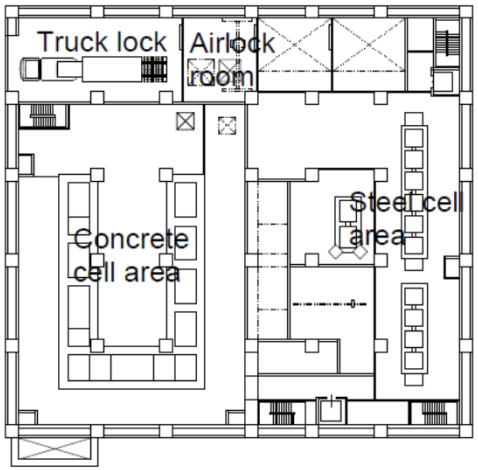
3. Details of Okuma Center (Topics of Laboratory-2 (3/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

➢ The arrangement of Laboratory-2



Schematic layout of Laboratory-2 (basement floor plan).

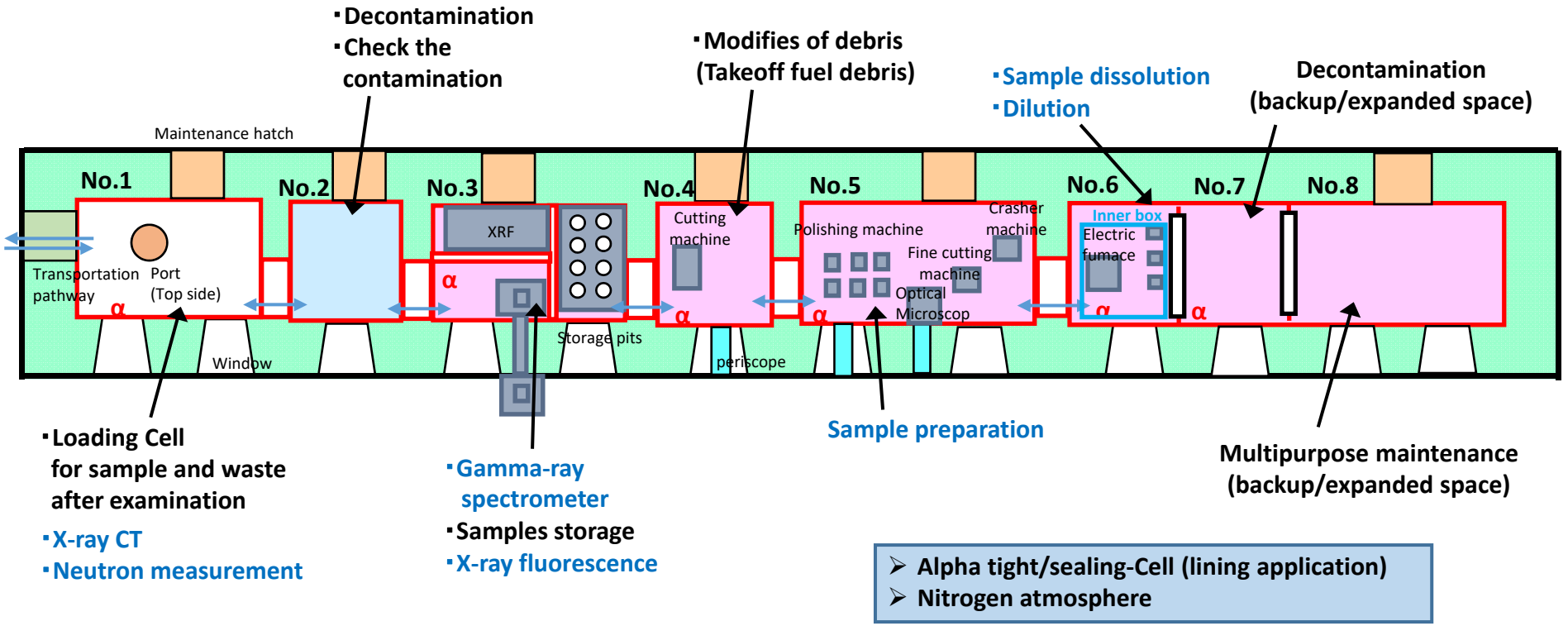


Schematic layout of Laboratory-2 (first floor plan).

3. Details of Okuma Center (Topics of Laboratory-2 (3/3))

◇ Okuma Analysis and Research Center
(1) Administrative building (2) Laboratory-1 **(3) Laboratory-2**

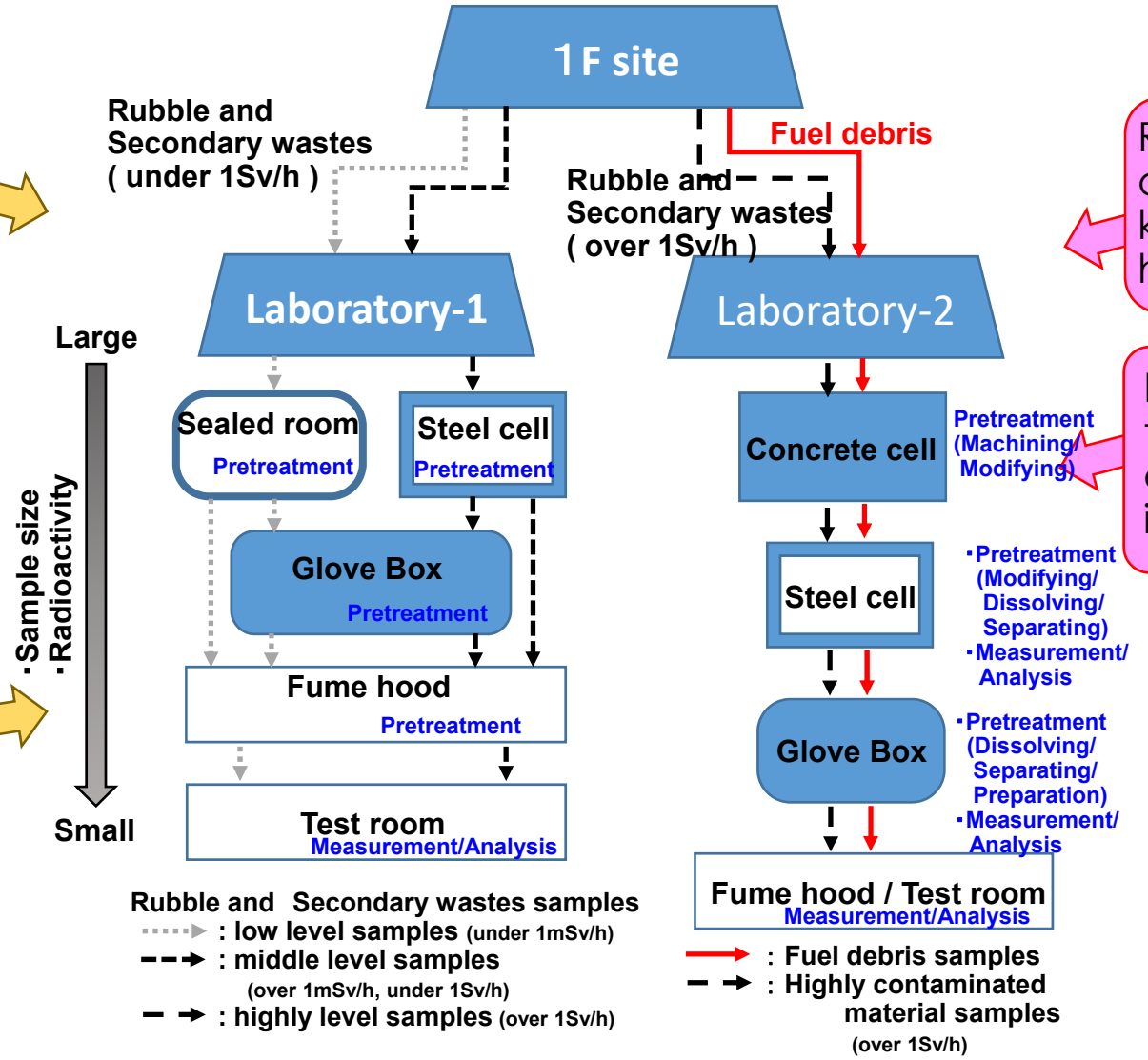
➢ The arrangement of alpha-concrete hot cell in Laboratory-2 (TBD)



3. Details of Okuma Center (Materials Flow)

Reference of PIE facilities knowledge in glovebox and Fume hood, etc

Apply of PIE analysis method in Tokai research and development center, etc.



Reference of PIE facilitie's knowledge in hot cells

Necessity of the activity and first impression

・Neutron measurement equipment
・X-ray CT
, and so on.

4. Summary

◇ According to the Roadmap, JAEA push the designing and building of the Okuma Center premeditatedly.

◇ In 2016, JAEA selected the basic analysis items for the significance and early phase in laboratory-2.
- Added the SEM/EDS and XRF for the simple analysis at receiving.
- Thermal equipment will be installed in medium phase.
- For the future request, Keeping the backup and maintenance space.

◇ But, JAEA will promote a design for laboratories based on the existing PIE's experience and knowledge. And the buildings will to be constructed according the plan, with safety .

Thank you for your attention.

Reference Slides

2. Background materials

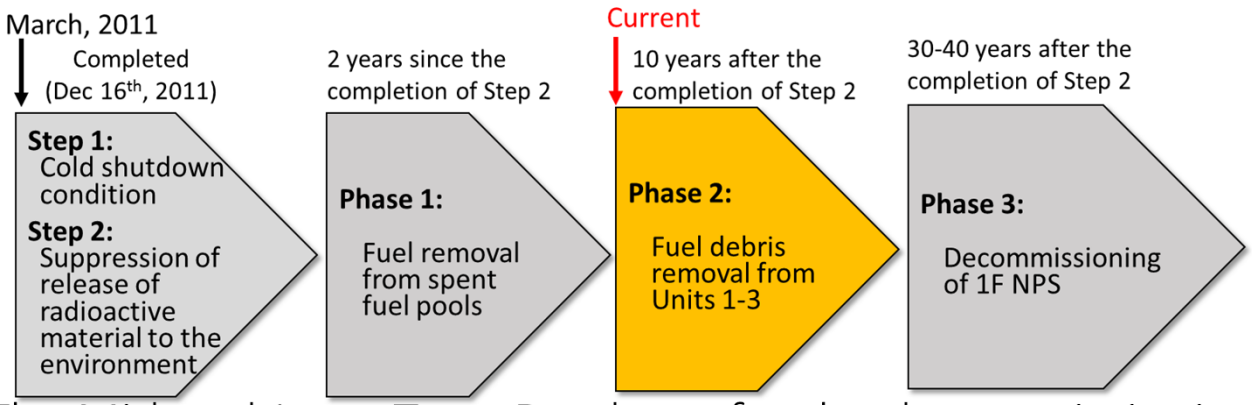


Fig. 1. The Mid-and-Long-Term Roadmap for the decommissioning of 1F NPS.

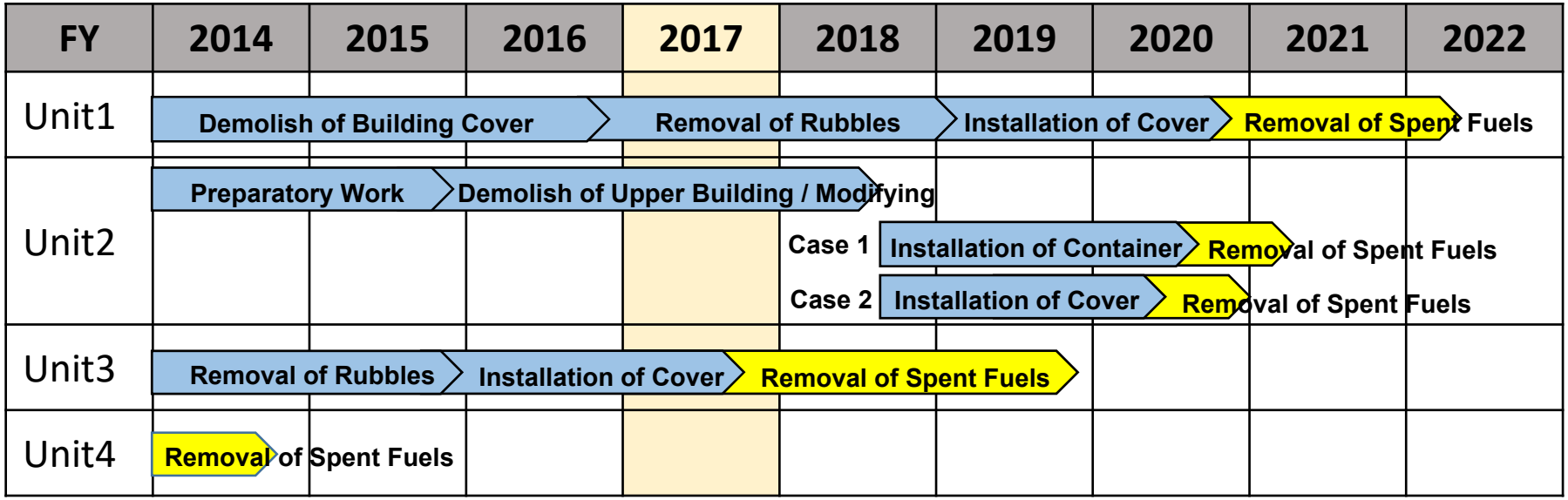
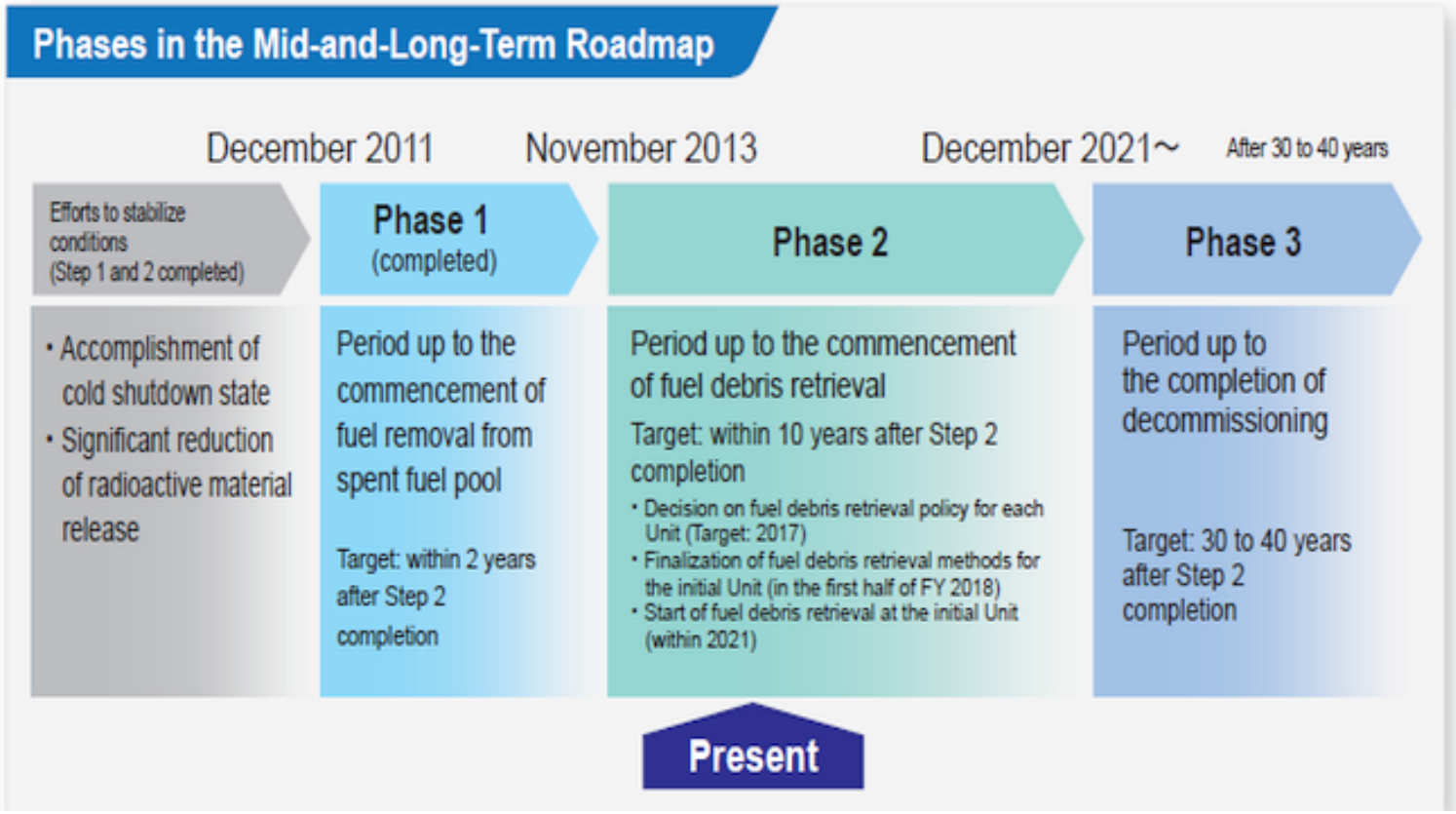


Fig. 2. The Mid-and-Long-Term Roadmap for the Spent Fuels (Phase 1).

※4号機使用済燃料：2011年11月～：ガレキ撤去、2013年11月～：取出し、2014年12月：完了

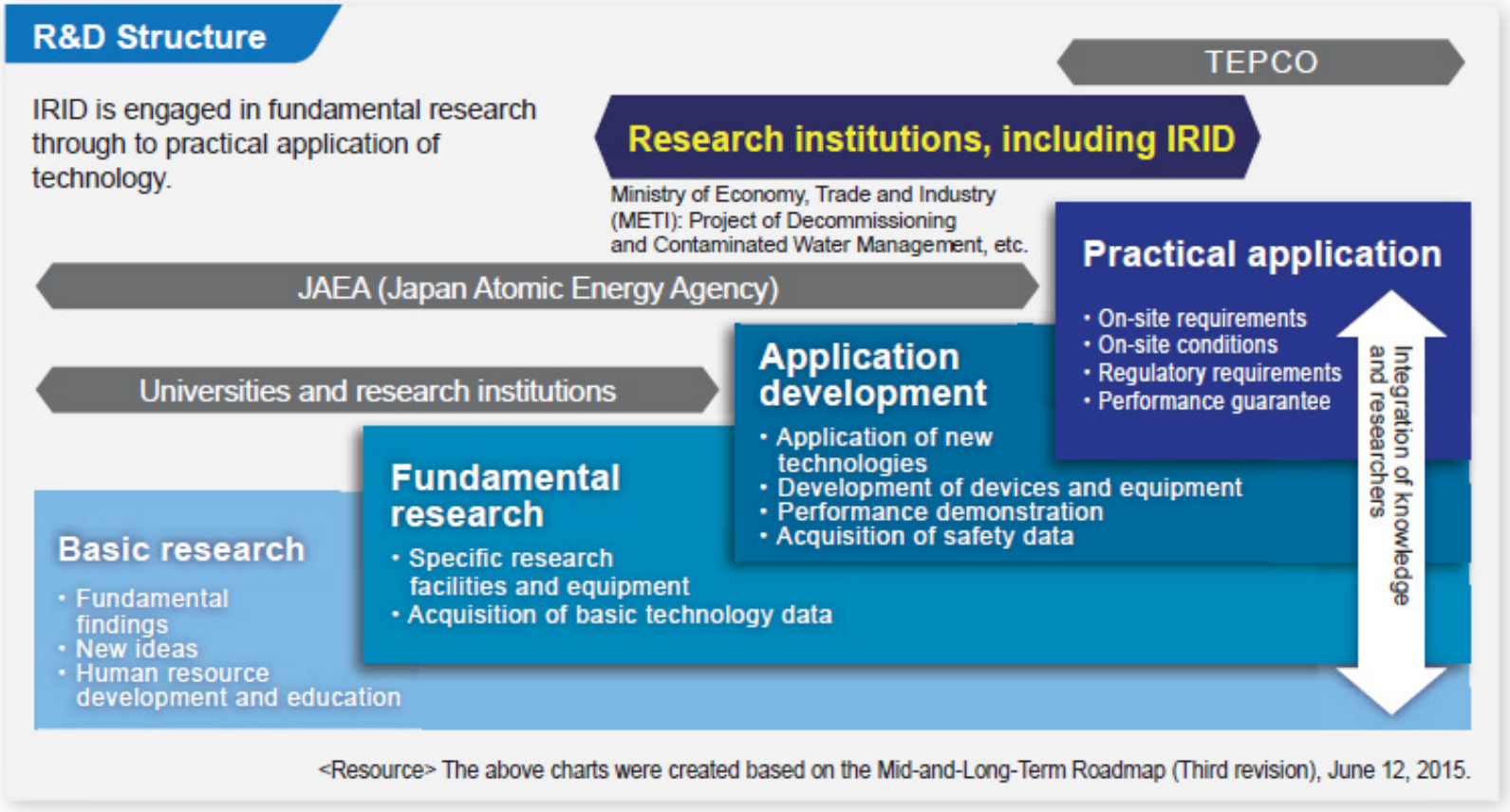
2. Background materials

Phases Defined in the Mid-and-Long-Term Roadmap and R&D Structure



※ http://irid.or.jp/_pdf/web_IRID_2016-2017_eng.pdf

2. Background materials



※ http://irid.or.jp/_pdf/web_IRID_2016-2017_eng.pdf