Summary of major responces to the RFI (classified into items and categories) [Topic 4 : Management of contaminated water inside the buildings]

Particularly-Requested Technologies for Contaminated Water Issues		Responces to the RFI			Trend of technical information in the responces	Expert Review Panel's Comments
item	Sub item	Category	No.	Key words		
(1)Water stoppage in the building	Stoppage of Leakage	Organic materials	92, 213 ,332, 339, 378, 434	Polymer, Silicic acid salt, Silicone resin	For water stopping technology in the building, there are many proposals of water stopping materials from both within and outside Japan, each of which is effective, used successfully in the construction field.	For water stopping technology in the building, there are many proposals that can be investigated immediately for application because they are proven in the construction field. It is recommended that more focus is put on access issues, identifying where leaks are located, and flexible responses – many of the proposals are material related and many of the deployment concepts may be unrealistic. Proper selection of the construction method and materials should be done based on the conditions in the building and the degree of dose. In case of stopping water infiltration from outside, it is necessary to evaluate a possible leak of indoor contaminated water to outside. For the decision of water stopping method, database of related water information should be established and the plan and risks are required to be determined adequately based on it. For the filling material into the building, it is better to consider the availability of dismantling at a later phase. Attention needs to be paid for the choise of filling material in order to avoid a hindrance to the operation of facilities for contaminated water treatment. There was a number of proposals on the freezing method for solidification of contaminated water, but it is necessary to pay close attention on the increase of water in order to avoid a damage to the structure, and the application may be restricted to certain freezing areas and or duration . The need to maintain cooling is an important aspect of the water management in the building – the International Team suggests that construction of the ice wall may provide some benefit as the infiltrated water will be chilled – potentially allowing a reduction in the amount of flowing water. There were a few decontamination proposals although this was not a clear request in the RFI. It is not a major topic for the water stoppage in the building. It is of primary importance to know where the contamination is located before decommissioning, and to select the best technology from the existing ones from an engineering point of view. The laser decontamination technology should be evaluated on processing effect (area per unit time). There is a suggestion of collection method of contaminated water, but post-reduction of groundwater flow is important for the collection operation inflow. In that case, it is necessary to consider measures against mud and debris as well as water remaining in the building bottom.
		Inorganic materials	123, 179, 721	Blast furnace slag ultrafine particle materials, Ultrafine cement, Slurry		
	Filling Method	Filling material	151, 159, 226, 236, 238, 254, 363, 563, 626	Underwater-non-separable plastic grout material(Concrete, Bentonite, Low-radioactive and low-heat-generation-type high-fluidity concrete)	For filling method from inside the building, there are many proposals for underwater-non-separable plastic grout which has high usage performance in the construction field both domestically and internationally. In addition to the proposals of various materials, there are suggestions of construction method by filling from tunnels or through long distance pipes. From the Japan Concrete Institute(JCI), there is a proposal of filling into the torus chamber with low-heat generation and high-fluidity concrete which has resistance to radioactivation, and a proposal of shielding around the containment vessel by spraying high-strength fiber-reinforced concrete.	
			42, 104, 237, 255, 253, 626	Other(Fly ash, crystalline minerals, Clay, Fiber reinforced concrete, Foaming urethane)		
	Solidification of Contaminated water	Solidification (Ice)	56, 390, 358, 536, 747	Freeze technique(Small piece split, Entire building freezing, Accumulated water freezing)	As a method for solidifying the contaminated water, there are proposals for freezing by LNG, liquid nitrogen, etc., and using bentonite-type materials and ore.	
		Solidification (Other)	37, 88, 566, 596	Materials(Sand, Minerals, Swelling clay, Bentonite)		
	Decontamination	Method	133	Ultra-high-pressure liquid nitrogen	Decontamination technologies using ultra-high-pressure liquid nitrogen, laser, zeolite, and microbe were proposed as proven methods.	
			307	Laser		
			507	Zeodoraito system absorbing material		
			585	Microbe		
	Other	Elemental technology	308	3D simulation technology	As a related elemental technology, there are many kinds of proposals, to use 3D simulation technology, to collect contaminated water by an automatic running carriage, to observe inside the reactors by specific fiber scope, about overseas case studies, and a tool to measure the internal environment. They are required to make further research and development.	
			575	Recovery of contaminated water		
			652	Fiber optic observation scope for inside the reactors		
			752	Case Studies		
			760	Measurement tool for the internal environment		

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(2)Water stoppage around the building	Material	Organic materials	87, 130, 154, 156, 435	Epoxy, Zeolite, Polyurethane, Silicon	For water stoppage technology around the buildings, there are proposals of water stop materials for gaps between the buildings and the surrounding ground, which use organic materials, inorganic materials, and microbes. They are proven and effective with many results in the construction field both domestic and overseas.	Also for the water stoppage around the building, there were many proposals that can be investigated immediately for application because they are proven in the construction field. As with the water stoppage in the building, the application of waterstops needs to be determined by adequately evaluating the plan and risks based on a variety of information that has been put into a database. In case that a frozen ground wall was not able to be used, it is important to investigate the second and the third options. Ultimately, the implementation of ice wall and the additional control on water will help address this topic, and mitigate the need to identify and manage all leaks. In regards to injection to the ground surrounding the building area, there is a risk that the contaminated water may pressure itself outwards, so the construction will need to be made only after understanding the area of contaminated ground. Some key industrial case studies of this topic are of note such as the work to hydraulically isolate the Dounreay shaft containing nuclear waste. It is considered that underground tunnel system is worth considering to eliminate interferences to work under high radioactivity. Proposals of comprehensive countermeasures are from academic societies of Japan which takes a neutral position. It is very useful for us to take them into consideration. For the unmanned construction by remote operation, since it will be required from the viewpoint of radiation exposure prevention, depending on the need in the future, the development of remote operation methods and unmanned machinery for operation around the building is desired. Furthermore, as there is a difficulty to utilize unmanned machine inside the building, expectations are placed for further study in this regard.
		Inorganic materials	95, 157, 439, 662	Clay, Ultrafine particle cement		
		Microbe	78	Calcite production		
		other	340, 508	General Comments		
	Application method	Conventional method of injection	63, 475, 580, 592, 670, 671	Injection (from underground space)	For injection method, there are injection proposals of underground space (tunnel or trench dug around the building) to eliminate interferences to work under the circumstances of high radioactivity and ground surface. Both methods are available by a combination of existing technologies. From the Japan Society of Civil Engineers, there are proposals to use underground space of shield tunnel and underground cavity whose construction technologies are well established. As for ground injection technology, proposals related to "the management measures to block ground water from flowing into the site (topic 5)" are included. Proposals of unmanned injection method by a remote-controlled boring machine and heavy machine control with 3D scanner system for decontamination were received. Both are in need of about a year for development for actual application. As others, there are proposals to vitrify the ground, to build impermeable wall inside of the frozen soil wall, and to manage the groundwater table by pumping between multiple impermeable walls. Also there is a proposal to stop groundwater by continuous barrier around the building.	
			11, 170, 278, 385, 546, 591	Injection (from ground surface)		
		Unmanned or Remote- controlled construction	227, 520 , 582, 590, 713	Remote control boring machine		
			595	Decontamination machine, Use of 3D scanners		
		Other method	417	Glassification of the ground soil		
			593	Soil-cement, Impermeable steel pipe wall		
			372, 672	Multiple impermeable layer, Water pumping		
			243, 297, 674	Impermeable barrier widely surrounding the entire building		
			721	Electro-kinetic method+well-point method		
(3)Other	Water Stoppage	Reactor connection	18	Low-fusing-temp heavy metal	As a technique for stopping the water for reactor core, the application of low-melting heavy metal, and low-temperature lead were proposed.	From the viewpoints of workability, effects, and waste disposal at a later phase, the low-melting-point metal method needs to be considered.