DECOMMISSIONING PROGRAM OF RESEARCH HOT LABORATORY IN JAEA
-TECHNICAL REVIEW OF DISMANTLING WORKS FOR THE LEAD CELLS Part2-

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Abstract

The Research Hot Laboratory (RHL) in Japan Atomic Energy Agency (JAEA) is the first facility in Japan for the post irradiation examination (PIE) on reactor fuels and structural materials, which had contributed to advancement of the fuels and materials since 1961. The building of RHL consists of two stories above ground and a basement, in which 10 heavy concrete and 38 lead cells were installed. In RHL, all operations for PIE had been completed in 2003. Then the decommissioning program has been implemented in order to promote the rationalization of research facilities in JAEA. As the first step of the program, PIE apparatuses and irradiated samples were removed from the cells, which have been managed as radioactive wastes. The dismantling of lead cells was initiated in 2005. At present 26 lead cells are successfully dismantled. This paper shows technical review of dismantling operations for the lead cells.

1. Decommissioning plan of RHL

The Research Hot Laboratory (RHL) in Japan Atomic Energy Agency (JAEA) was constructed in 1961 as the first the post irradiation examination (PIE) facility in Japan. In RHL, various PIEs had been performed to provide the surveillance data of reactor fuels, pressure vessel steel and graphite materials for the Tokai Power Station of Japan Atomic Power Company, and to support the R&D activities in JAEA for the investigation of irradiation behavior of fuels and unclear materials. After the completion of its PIE mission, the decommissioning was started along the 3 steps, dismantling the lead cells, decontamination of concrete caves and the exclusion of the controlled area. At present, 26 lead cells has been successfully dismantled. Figure 1 illustrates the floor plan of RHL (first floor).

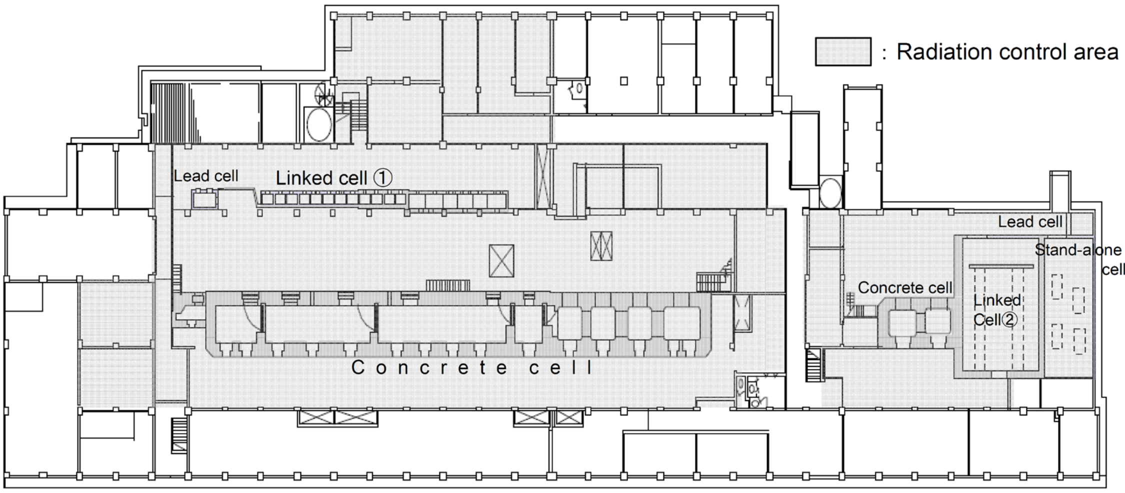


Fig.1 The floor plan of RHL (first floor)

2. Decommissioning plan of RHL

The final target of the decommissioning plan is to exclude of the radiation control area in RHL. There are three main steps to exclude the controlled area, which are dismantlement of lead cells, decontamination of concrete cells and final decontamination for all of the controlled area. At the first step, the decontamination of lead cells are dismantled. This paper describes the dismantlement work of these cells. At the second step, the decontamination of concrete cells will be started with dismantling of inner apparatuses and the removal of radioactive waste. Finally, the operation room and service room are decontaminated and whole the controlled area will be excluded at the third step. Decommissioning process for the lead cells is shown in Fig.2 and overview of decommissioning plan is shown in Table 1.

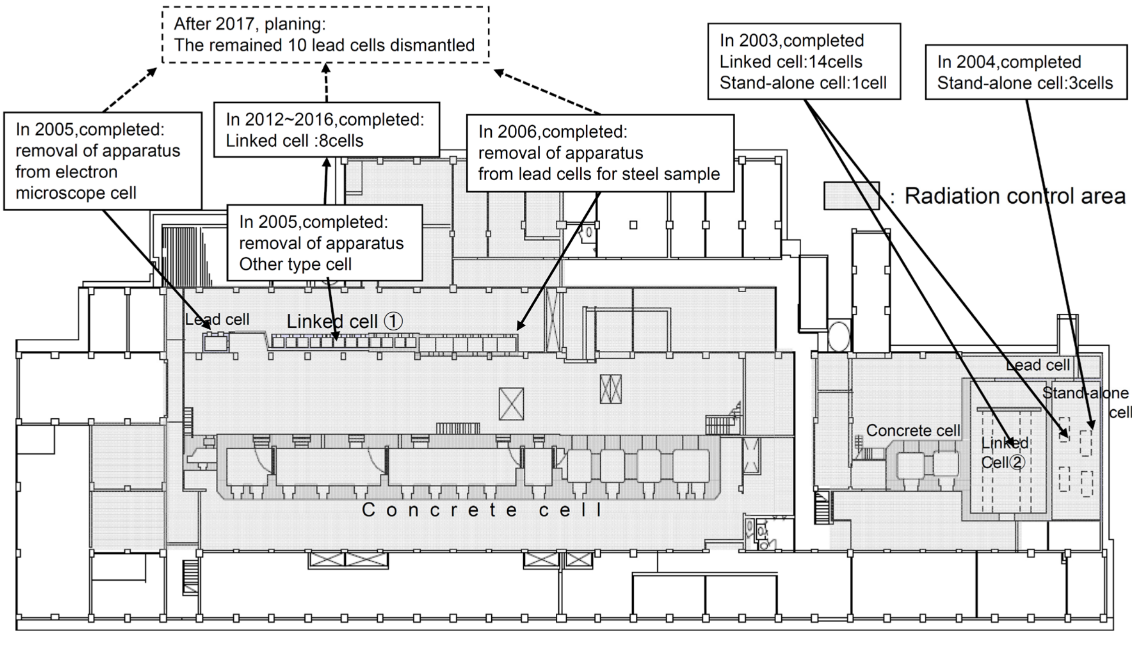
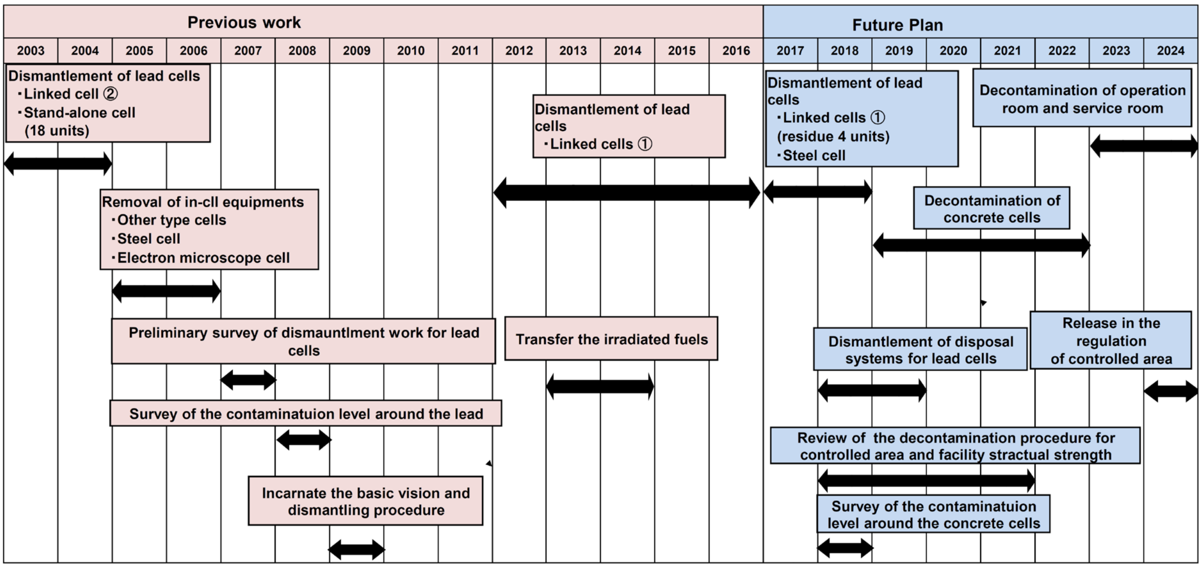


Fig.2 Decommissioning process for the Research Hot Laboratory (for lead cells)

Table 1: Overview of decommissioning plan for the Research Hot Laboratory



3. Procedure of dismantlement works

3.1 Specification of lead cell

There are two types of linked cells. One types(linked cells①) is 12 lead cells in a row as shown in Fig. 3. The other one(linked cells②) is 14 lead cells and each 7 cells are linked each other shown in Fig. 4. Figure 5 shows 4 lead cells as stand-alone type. Their front walls are constructed with the 10 stacking of the wedge lead blocks (30 – 50 kg each), and the lead glass and manipulator socket are settled for each wall. The foundation and back wall are constructed with the heavy concrete, and the steel plates (25mm) are used for the ceiling and isolation wall. Table 2 shows the specification of these lead cells.

Fig. 3 linked cell ①

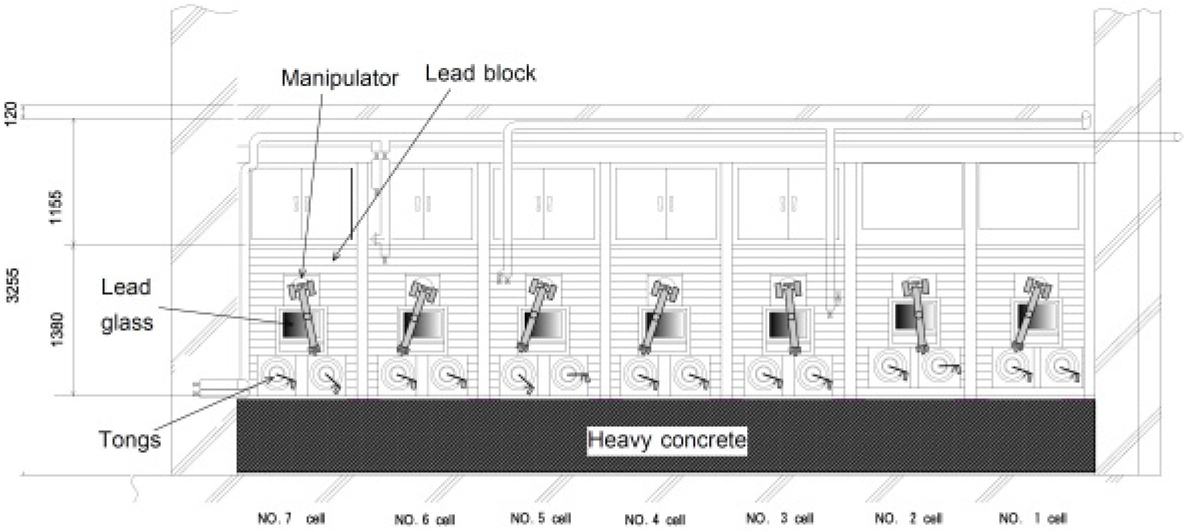


Fig.4 linked cell ②

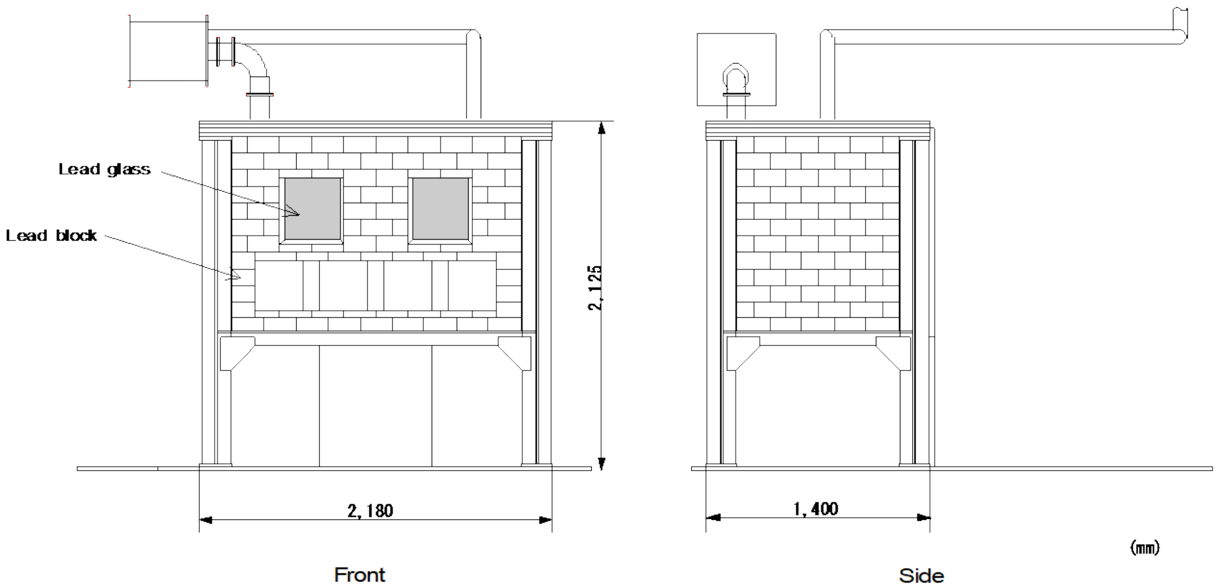


Fig.5 stand-alone cell

Table 2: The specification of lead cells

Cell	structural dimension	Rsults(Dismantlement)
Linked cell ① 12 cells	・13,000 mm Wide, 2,450 mm High, 1,740 mm Deep ・Front: lead block, ceiling: steel plates, foundation: heavy concrete （shield thickness: lead block179mm and 254mm、ceiling plates200mm,250mm）	・In 2013：2 cells ・In 2015：4 cells ・In 2016：2 cells
Linked cell ② 14 cells(7×2)	・7,800 mm Wide, 3,255 mm High, 1,300 mm Deep ・Front: lead block, ceiling: steel plates, foundation: heavy concrete （shield　thickness：lead block150mm、ceiling plates150mm）	・In 2004：14 cells
Stand-alone cell 4 cells	・2,180 mm Wide, 2,125 mm High, 1,400 mm Deep ・Lead block knockdown structure（shield thick：100mm） ・Ceiling plates and foundation of Steel（shield thickness：75～100mm） ・Unwelded structure	・In 2003：3 cells ・In 2004：1 cells

3.2 Dismantling procedures

After the dismantling of inner apparatuses and the removal of radioactive waste, the lifting frame was assembled surrounding the target cell as the mounting of the chain block and trolley as shown in Fig.6. Whole the cell and lifting frame were covered with the isolation tent to prevent the contamination release. Following these preparations, the dismantling was started from the removal of ceiling plate with the electric-powered tools (drills or grinder) for the cutting of welded parts. After the ceiling removal, lead blocks were removed from the top one as shown in Fig.7, and the isolation walls were removed subsequently with the chain block and trolley. The remained foundation was fractured with the jackhammer and the chemical infusion materials. To prevent the falling down of isolation walls during the dismantling, those walls were hung with the chain block through the dismantling process. Additionally, the temporary support wall was settled for the countermeasure of lead block collapse.


Fig.6 The lifting frame


Fig.7 Removal of lead blocks

3.3 Radiation control and work rate of dismantlement

Table 3 shows the maximum dose rate and the number of persons engaged in the dismantling of each cell.

Table 3: Radiation control and work rate of dismantlement works

Decommissioning work	Maximum dose equivalent rate (μSv/h)	Air dose rate (μSv/h)	Total exposure dose of worker (μSv)	Days of work	number of persons engaged (person-day)
Decommissioning of linked cells①	45.0	0.7	419	114	1,274
Decommissioning of linked cells②	2.0	B.G(<0.2)	No significant exposure	80	1,006
Decommissioning of stand-alone cells	1.6	B.G(<0.2)	No significant exposure	50	481

3.4 Generated waste of dismantlement works

Table 4 shows the waste amount generated from the dismantling of each cell. The indicated weight includes both radioactive and non-radioactive one.

Table 4: The weight of generated waste and stored material

Decommissioning work	dismantling cells	Lead block		Steel stock		Heavy concrete		Other	
		contamin ation	no contamin ation	contamin ation	no contamin ation	contamin ation	no contamin ation	contamin ation	no contamin ation
Linked cells ①	8	27,262	-	54,479	-	-	-	8.322	-
Linked cells ②	14	768	28,889	1,800	41,777	-	2,716	430	25,145
Stand-alone cells	4	1,598	2,2311	1,800	41,976	-	4,592	645	10,333

4. Future Plan and Conclusions

This decommissioning has been smoothly progressed. We obtained effective data on steps of decommissioning lead cells and radiation protection.
Near future, the remained 11 lead cells will be dismantled, where air radiation dose rate and contamination by radioactive material are higher than the cells already dismantled. Therefore, radiation control, contamination control and reduction of radioactive waste are more important issue. However, this will be able to be solved by experience and obtained data through the decommissioning work described in the present paper.

Acknowledgment

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References

[1] Y. Nozawa, T. Kouya, H. Sekino, “Decommissioning of the Research Hot Laboratory (Dismantlement works of lead cells)”, JAEA-Technology 2007-004 (2007)