

Annex I, Part B

Appendix VII: EXPECTED DURATION OF INDIVIDUAL TASK

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Decommissioning of Research Reactor
Work plan for removal of core vessel and reflector tank

Line no.	Subtask	Identification in photo	Relevant drawing or other documentation	Remarks	Risks	To be performed by	Necessary tools and other equipment	Personal protection equipment in addition to safety shoes	Other precautions	Assistance by radiation protection technician	Special dosimeters to be used	Waste container to be applied	Samples to be taken	Expected dose rate at the working place	Expected time consumption (for work in the radiation field)	Expected radiation doses	Expected amounts of radioactive waste [unit]	Expected amounts of non-radioactive waste [unit]	
1	Work going on during the whole operation																		
2	Taking photos/videos					KL	Cameras with fully charged batteries	Safety helmet where required						?	?				
3	Marking of the dismantled parts		Memo on identification and marking of graphite blocks		Radiation from the graphite Drop of graphite stringer	PEB	Tape, speedmarker	Gloves (graphite)			Possibly finger dosimeters								
4	Documentation of the work and the dismantled parts		Task description Waste ID guide			KL/PEB	Necessary forms. Possibly a PC												
5	Preparatory work:																		
6	1" Al-pipe going through the core vessel (the glory hole pipe) cut loose and taken out					HJ/PEB													
7	Order 2 concrete shielded drums for the core vessel, drain pipe and connecting pipe					HJ/PEB													
8	Provide containers for other waste and decide where to place these			"Blue" pallet containers and containers for small active samples (plastic bottles and a lead bucket)		HJ/PEB													
9	Produce lifting gear for the core vessel	Photo 5215 and 5216	71203	Must be certified		HJ													
10	Mount rails and skirting board on top of the biological shield					HJ/HY													
11	Mount the swinging crane			Must be able to reach all the way over the reflector tank and over the roof of the control rod house		HJ/HY		Safety helmet											
12	Prepare the suction pads			Ascertain that the supply of pressurised air is OK		HJ/HY													
13	Test the function of the swinging crane and the suction pads			Simulate removal of a stringer from the reflector tank and transfer to a pallet container placed at the roof of the control rod house	Risk of falling down on the reflector tank	HJ/HY, PEB, KL, RPT		Safety line		X			?						
14	Produce a frame to center the core vessel in the waste drum					HJ													
15	Prepare shielding of the core vessel and connecting pipe during the removal of the first 7 layers of graphite					PEB, HJ, BL													

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16	Plan measurements of radiation levels and health physics surveillance					AHF, KL													
17	Initial work:																		
18	Removal of plugs in experimental channels	Photos from the characterisation report		Intermediate storage in the reactor hall		SBJ m.fl.	Pallet and pallet transporter												
19	Removal of concrete shielding blocks at the top of the reactor	Photos from the characterisation report		Intermediate storage in the reactor hall															
20	Remove the steel tray on top of the reflector tank	Photos from the characterisation report		Intermediate storage in the reactor hall															
21	Inject plastic foam into the connecting pipe between the core vessel and the recombiner	Photo no. 5215	971201	Blind plate to be replaced afterwards	Incomplete filling of the pipe	HJ/HY	Plastic "stocking" to pull the pipe into			X	Finger- and wrist dosimeters			?					
22	Remove the shielding blocks between the reflector tank and the lead wall to the recombiner vault	Photo IMG_1257		The blocks may be slightly activated	Dropping blocks	HJ/HY	Lifting gear			X	Finger- and wrist dosimeters	"Blue" pallet container							
23	Measure radiation levels					RPT													
24	Establish the working place				Slippery floor at the top	HJ/HY			Lay on non-skid coating of the floor										
25	Cutting of the connecting pipe in the space between the reflector tank and the concrete shield	Photo IMG_1257		Possibly apply a lead plate to shield the pipe	Contamination from escaping material	HJ/HY	Saw and a tray or similar for collecting chips	Safety helmet, dust mask	Prepare exhaustion	X	Finger- and wrist dosimeters		Chips to be collected now. Slices of the pipe to be cut out later						
26	Removal of the lead wall between reactor vault and recombiner vault	Photos IMG_1226 og IMG_1257		Intermediate storage in the reactor hall - remember plastic cover of the floor	Drop of lead wall during transport	HJ/HY		Safety helmet							30 minutes				
27	Removal of the free end of the connecting pipe, including the flange, and transfer to the waste drum				Contamination from escaping material	HJ/HY	Lid or plastic bag to cover the open ends of the pipe	Safety helmet, dust mask	Prepare exhaustion	X	Finger- and wrist dosimeters	Concrete-shielded drum (possibly plastic bag and placement in shielded cell)							0
28	Checking the radiation levels in the recombiner vault			Low radiation level expected		RPT				X									
29	Removal of isolated cooling pipes in the recombiner vault					HJ/HY		Safety helmet		X									
30	Fuel level indicator to be cut free from the drain pipe					HJ/HY	Tray or similar for collection of possible fluid	Safety helmet											
31	The drainpipe to be cut and checked for possible content of fluid					HJ/HY	Container for collection of fluid	Safety helmet											

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32	Removal of pipes and valves in the recombiner vault				Risk of injury to head Risk of escape of core fluid	HJ/HY	Container for collection of fluid. Box spanners, wrenches, screwdrivers, hacksaw	Safety helmet	Exhaustion prepared Air monitor active	X		Strong plastic. Pallet-container and a bucket in the shielded cell	Pipes to be cut close to where they enter into the concrete	35-130 µSv/h	1 hour	50 µSv	10 kg	10 kg	
33	Tidying and cleaning in the recombiner vault					HJ/HY													
34																			
35	Drilling out the drain pipe																		
36	Cut a 50-60 mm hole around the drain pipe where it protrudes from the reflector tank				Risk of injury to head. Heating of the graphite inside the tank	HJ/HY	Hole-saw	Safety helmet		X		Plastic bag	The cut out piece is in itself a sample	35-100 µSv/h	10 minutes	10 µSv			
37	Weld a mounting for the drilling machine on the reflector tank and mount the drilling machine				Risk of injury to head Heating of the graphite inside the tank	HJ/HY	Welding equipment	Safety helmet		X				35-100 µSv/h	20 minutes	20 µSv			
38	Drill a core of reflector graphite with the drain pipe in the centre until the drain pipe is cut below the core vessel			Graphite powder will be produced during drilling	Risk of injury to head Heating of the graphite inside the tank	HJ/HY	Core-drill Vacuum cleaner Plastic for wrapping up drilled-out material	Safety helmet, dust mask		X		Plastic bags The drain pipe to be placed in the shielded cell		35-100 µSv/h	1 hour	35 µSv	500 g	2 kg (graphite)	
39	Removal of graphite and core vessel																		
40	Graphite stringers in layers no.13 to no. 9 to be removed, weighed, marked, registered and transferred to pallet containers	Photo no. 5215	71101 - 1 & 2	Remember shielding of the core vessel and the connecting pipe (e.g. using bags with lead bullets in the central hole)	Falling into the reflector tank Drop of graphite blocks	Removal: HJ/HY Marking: PEB	Suction pads (pressurized air), guide rod, swinging crane, "HF-tape", speed markers	Safety helmet, possibly dust masks	Exhaustion prepared Air monitor active	X		Pallet container	Selected stringers to be put aside in accordance with instructions from waste characterisation lab.	1-50 µSv/h	7 hours	80 µSv			
41	Cutting of the connecting pipe in a plane less than 16 cm from the centre of the core vessel	Photo no. 5215	971201, 71203, 71205	Remember shielding of the core vessel and the connecting pipe	Contamination from escaping material	HJ/HY	Saw and a tray or similar for collecting chips	Dust mask	Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters		Later	300-800 µSv/h	10 minutes	80 µSv			
42	Transfer of the cut-off pipe to a concrete shielded drum				Pipe stuck in tank wall	HJ/HY	Long-handled tongs Plugs for the pipe-ends	Dust mask	Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters	Concrete-shielded drum		50-300 µSv/h	5 minutes	10 µSv			
43	Cutting out samples from the wires to thermo elements	Photo no. 5215				HJ/HY	Long-handled tongs and gripping tool			X	Finger- and wrist dosimeters	Sample container		50 µSv/h	1 minute	1 µSv	0,5 kg		
44	Cutting loose the wires to the thermo elements	Photo no. 5215		Remember shielding of the core vessel and the connecting pipe		HJ	Long-handled nippers			X	Finger- and wrist dosimeters			300-2000 µSv/h	1 minute	5 µSv			

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45	Mounting a lifting collar on the pipe end at the top of the core vessel	Photo no. 5215	71203	Remember shielding of the core vessel and the connecting pipe (e.g. using bags with lead bullets in the central hole)	Fall into the hole	HJ	Lifting collar and appropriate tools	Possibly dust masks	Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters		300-2000 μ Sv/h	2 minutes	10 μ Sv			
46	The necessary number of graphite stringers from layers 8 and 7 to be removed, weighed, marked, registered and transferred to a pallet container	Photo no. 5215	71101 - 1 & 2	Remember shielding of the core vessel and the connecting pipe	Fall into the hole. Drop of graphite stringers	Removal: HJ/HY Marking: PEB	Suction pads (pressurized air), guide rod, swinging crane, "HF-tape", speed markers	Possibly dust masks	Exhaustion prepared Air monitor active	X		Pallet container	Selected stringers to be put aside in accordance with instructions from waste characterisation lab.	60 μ Sv/h	2 hours	90 μ Sv		
47	Ensure that the core vessel is free and can be lifted					HJ			Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters			2 minutes				
48	Check the maximum cross section of the core vessel in order to ensure that it can go into a shielded drum			No problem if no pipes protrude beyond the diameter of the vessel		HJ				X	Finger- and wrist dosimeters		800 μ Sv/h	2 minutes	25 μ Sv			
49	Weigh the core vessel			May be done during the actual lifting out of the vessel		HJ/HY/KL	Weighing cell	Dust mask	Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters		120 μ Sv/h	2 minutes	5 μ Sv			
50	Lifting out the core vessel and transferring it to a shielded drum and mounting the lid on the drum				Contamination from escaping material	HJ/HY	Approved lifting gear	Dust mask	Exhaustion prepared Air monitor active	X	Finger- and wrist dosimeters	Concrete shielded drum	120 μ Sv/h 800 μ Sv/h	5 minutes 1 minut	10 μ Sv 10 μ Sv	30 kg		
51	Place the drum in a shielded cell in the reactor hall				Dropping of the drum from the crane	HJ/HY	Approved lifting gear			X	Finger- and wrist dosimeters		60 μ Sv/h	5 minutes	5 μ Sv			
52	If necessary fill the drum with steel balls and/or low-active metal parts for extra shielding					HJ/HY				X	Finger- and wrist dosimeters			10 minutes				
53	Remove the remaining graphite stringers			If the radiation levels permit it, it can be considered to send a man down into the reflector tank	Fall into the hole Drop of graphite stringers Contamination on the stringers	Removal: HJ/HY Marking: PEB	Suction pads (pressurized air), guide rod, swinging crane, "HF-tape", speed markers	Safety helmet, possibly dust masks	Exhaustion prepared Air monitor active	X		Pallet container	Selected stringers to be put aside in accordance with instructions from waste characterisation lab.	4 hours				
54	Check the radiation level inside and on the outer surface of the reflector tank				Fall into the hole	RPT				X				5 minutes				

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55	Remove experimental channels between reflector tank and concrete walls	Photo no. IMG_1250, IMG_1253, IMG_1254 og IMG_1257		The connection between the channels and the tank are only tightend by means of tape, while in the other end the channels are welded to the steel plates on the biological shield	The channels may be (slightly) activated close to the tank	HJ/HY	Saw and a tray or similar for collecting chips	Safety helmet, possibly dust masks		X - depending on radiation level		"Blue" pallet container			4 hours				
56	Loosen and lift out the reflector tank	Photo no. 5218 A, 5218 B, IMG_1251 og IMG_1252		The tank is bolted to the floor in four places. Temporary storage in the reactor hall. If necessary, shielding must be established.		HJ/HY + possibly more	Approved lifting gear	Safety helmet	Floor to be covered by plastic where the tank is to be placed	X - depending on radiation level					1 hour				
57	Final work:																		
58	Carry out measurements for sorting of waste (into active and potentially non-active) and take samples of waste to be disposed of as radioactive			Instructions for this to be given by the Waste Treatment Plant		HJ/HY RPT						Possibly container for samples							
59	Check radiation levels around the shielded cell					RPT													
60	Check radiation levels in the reactor vault					RPT													
61	Tidying and cleaning in the reactor vault					HJ/HY				evt.									
62	Finalise the accounting of personnel doses					RPT/HF/KL													
63	Input data to data base					HF/KL													
64	Write the report about the work					KL													

Acceptance of the plan

Role/Unit	Name	Acceptance date
Project leader	PL	sign. 12.01.2005
Workshop	Responsible WS	sign. 12.01.2005
Health physicist	Responsible HF	sign. 15.01.2005
Waste treatment plant	Responsible WTP	sign. 16.01.2005
Safety group	Responsible SG	sign. 16.01.2005

Acronyms used:

AHF	Applied Health Physics	KL	Projekt Leader
AS	Worker A. S.	PEB	Worker P.E.B
BL	Worker B. L.	RPT	Radiation protection technician
HF	Health physicist	SBJ	Worker S.B.J
HJ	Worker H. J	SC	Worker S.C.
HY	Worker H. Y.		

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