IAEA R²D²P Workshop on Cost Estimates

Group #3 Report
- Temporary Waste Store -

Manila, 30 March - 03 April 2009

Group #3 Composition

- Brazil
- Egypt
- Indonesia
- Malaysia
- Philippine
- Romania

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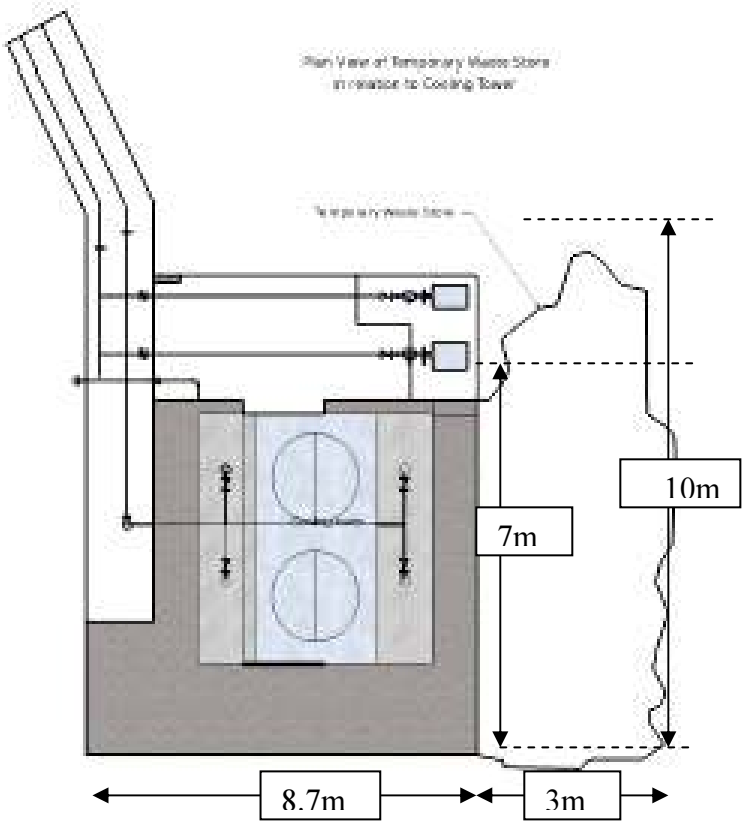
Part I
Temporary Waste Store Description

Historical Background

- The Temporary Waste Store is not a planned part of the reactor;
- It was used by large forklift when the reactor's spent fuel elements were shipped out;
- It stayed by the side of the cooling tower, and have attracted the uncontrolled and unorganised dumping of junk from other sources, not from reactor.

Location Area



- Total area about 30 m²
- Mass of any contaminated Object < 2-ton;

Actual Status (1)

Photographs of the Temporary Waste Store

Actual Status (2)

View of the Temporary Waste Store.
Note the Cooling Tower in the background.

Stored Items

Temporary Waste Store Component List

Name	Material	Mass (kg)	Remarks
Heat Exchanger	Al, CS	600(Al) 50(CS)	From reactor's old primary cooling loop
Heat Exchanger Tube Bundle	Al, CS	300(Al) 25(CS)	From reactor's old primary cooling loop
8-inch Pipe Assembly	Al	110	From reactor's old primary cooling loop; 7m total length
8-inch Pipe Assembly	Al	35	From reactor's old secondary cooling loop; 2m total length
8-inch Pipe Assembly	Al	20	From reactor's old secondary cooling loop; 1m total length
Scrap Ducts	GI	10	From reactor's old ventilation system
Disassembled Fan Shroud	GI	100	From reactor's old cooling tower
Scrap Water Pipe	GI	10	Not from reactor; 3" size, 3 m total length
Scrap Electrical Tubing	GI	10	Not from reactor; in bag
Scrap Metal Sheets	CS	50	Not from reactor; 5 sq m
Scrap Metal	CS	5	Not from reactor; discarded air conditioner cover
Plastic Pipe	Plastic	2	Not from reactor
Stainless Steel Boxes	SS	100	Not from reactor; discarded machine shop project
Waste Drum	GI	30	Not from reactor

Contamination Status

- The material in the Temporary Waste Store were:
- A.obsolete components of the reactor's cooling system from both the primary and secondary loops and some cut-up ventilation ducts.
- These were scanned at the time they were removed from the reactor and have no external surface contamination. However, the internal surfaces were not scanned or sampled.
- B. Other uncontaminated Object not from the reactor are not believed to have any original contamination.

Assumptions

- Total area of the waste store is about 30 m^2
- Mass of any individual contaminated Object in the waste store is less than 2-ton, so no need for cutting or Dismantling of any components from the contaminated Object
- Material that had wetted surfaces in the reactor's primary loop may contaminated the other materials in the heap as well as the soil in the area.
- Since all items were scanned at the time they were removed from the reactor and have no external surface contamination it assume that:
  - Less than 0.005 mSv/h at the external surface
  - labelling: I-White
  - Transport Index (T.I.) = zero
  - The external radiation level at 3 m from the unshielded material or object or collection of objects does not exceed 10 mSv/h.

for all Items

Part II
Detailed Work Breakdown
- Work plan by Group 3 -

Detailed Work Breakdown
- Work plan by Group 3 -

Phase 0:

- 1. Formulate a plan of the activities needed to dismantle and remove the objects in their assigned field area.
- 2. Prepare a detailed work breakdown and a cost estimate.

Detailed Work Breakdown

- Work plan by Group 3 -

Phase 1: Radiation characterisation

- 1-Background measurement (one)
- 2-Materials scanned for surface contamination are:
  - All the materials in the area are:
  - Soil in the area
- 3-Materials have Smear samples taken from internal surfaces for laboratory analysis:
  - Primary loop and ventilation system and have internal surfaces (such as an obsolete heat exchanger or air ducts)
  - The soil in the area

Detailed Work Breakdown

- Work plan by Group 3 -

Phase 2: Waste Disposal

- **Contaminated Waste Disposal:**
  - **A) All materials that are identifiably from the reactor's primary coolant loop or ventilation system must be brought to a collection area (A) about 200 meters away, where it will undergo a final survey and be cleared.**
  - **B) Any contaminated material, whether from the primary loop or not, must be brought to the same collection area.**
  - **C) Contaminated object should be wrapped and taped in plastic sheeting before being transported and Labelling (I-white) with a T.I=zero**
  - **D) Soil contaminated packaged in 200 -liter drums and brought to the Radwaste Storage Facility about 200 meters away.(Labelling as II-Yellow or III-Yellow according to the activity found).**

Detailed Work Breakdown
- Work plan by Group 3 -

Phase 2: Waste Disposal

Uncontaminated Waste Disposal:

- All uncontaminated waste are:
- A)Materials presorted categorizes as:
  - i) Metals, sorted separately:
    - Aluminum (Al)
    - Stainless Steel (S.S.)
    - Galvanized Steel (G.I.)
    - Carbon Steel (C.S.)
  - ii) Plastic
- B) Delivered to collection area (B) 200 meters away.

Part III
Procedures

Procedures Considered by WG #3

- **The procedures considered by the WG #3 are as follows:**
  - **Procedure for Scanning Surfaces for Beta Contamination**
  - **Procedure for Scanning Surfaces for Gamma Contamination**
  - **Procedure for Smear Sampling for Removable Surface Contamination**
  - **Procedure for Shallow Soil Sampling**

Part IV
Estimated Cost

List of Activities and Workers (1)

Model case:			Type of decom. activity	Decom. category inventory item	Total number of workers
	No.	Name of the decommissioning activity			
					0.0
		Phase 1 Planning			0.0
	1.1	Action Plan	PERD		3.2
	1.2	Survey of work hazards			3.0
	1.3	Identification of cuts and surfaces			3.0
	1.4	Elaboration of the conceptual plan for the waste store	PDA		3.5
	1.5	Elaboration of the characterisation plan for the waste store	PDA		3.5
	1.6	On site inspection and radiological characterisation of temporary waste store	PDA		4.0
	1.7	Preparation of waste containers and logistic for the transport			
A	1.8	Elaboration of the procedures for decommissioning of the waste store	PDA		9.0
	1.9	Approval of the procedures by the operator	PDA		8.0
	1.10	Acceptance of the procedures by the regulator	PDA		8.0
	1.11	Payments to regulator	CC		0.0
	1.12	Personnel Refreshment Training			
	1.13	Physical Protection Measures			
	1.14	Contingencies Plan			

List of Activities and Workers (2)

		Phase 2 - Procurement of equipment			0.0
	2.1	Soil sampler	CC		0.0
	2.2	Equipment for preapration of soil samples for measurement	CC		0.0
	2.3	Set of tools for unbolting the heat exchanger	CC		0.0
	2.4	Personal protective Equipment (PPE)			
	2.5	TLD/Film Badge			
	2.6	Survey Meter			
	2.7	Hand & Foot Monitor /Portal Detector			
		Phase 3 Main Activities			
	3.1	Transport of tools into the working area			5.2
	3.2	Preparation of tools in the working area			5.1
	3.3	Installation of the protective tent			0.1
	3.4	Preparation of the workgroup for dismantling			1.0
	3.5	Preparation for Surface Scanning			2.1
	3.6	Preparation for sorting waste			3.0
	3.7	Preparation of waste containers			7.0
	3.8	**Surface Scan Material and Soil**			
	3.8.1	Background Measurement			2.0
	3.8.2	Instalation of protective tents			0.1
	3.8.3	Calibrated portable rate meter with NaI scintillator detector. Gamma check source.			2.0
	3.8.4	Calibrated portable rate meter with thin-window gas-proportional or scintillator detector. Beta check s			

List of Activities and Workers (3)

	3.9	**Monitoring**			
	3.9.1	Monitoring of primary pipe			
	3.9.2	Monitoring of secondary pipe	IDA	MBGP	2.0
	3.9.3	Monitoring of non active water pipes	IDA	MMDP	2.0
	3.9.4	Monitoring of electical tubing, scrap	IDA	MFMS	2.0
	3.9.5	Monitoring of carbon steel sheets	IDA	MFMS	2.0
	3.9.6	Monitoring of aluminium tubes	IDA	MFMS	2.0
	3.9.7	Monitoring of carbon steel sheets	IDA	MFMS	2.0
	3.9.8	Monitoring of aluminium pipe	IDA	MBGP	2.0
	3.9.9	Monitoring of ventilation duct, segment	IDA	MFMS	2.0
	3.9.10	Monitoring of air conditioning segment	IDA	MFMS	2.0
	3.9.11	Monitoring of plastic pipe	IDA	MMDP	2.0
	3.9.12	Monitoring of aluminium pipe	IDA	MBGP	2.0
	3.9.13	Monitoring of stanless steel boxes	IDA	MFMS	2.0
	3.10	Taking smear samples	IDA	TSMP	2.0
	3.11	Taking soil samples	IDA	TSSM	2.0
	3.12	Unbolting the heat exchanger	IDA	UNBF	4.0
	3.13	Sampling of the heat exchanger	IDA	TSMP	2.0
	3.14	Smear sample measurement in laboratory	IDA	MSMP	1.0
	3.15	Soil sample measurement in laboratory	IDA	MSLS	1.0
	3.16	**Sorting (Contaminated/Non Contaminated) Material**			
	3.16.1	Indentification and preparetion of the clean area for NCM			4.5
	3.16.2	Cut in small pieces the non-contaminated material			7.5

List of Activities and Workers (5)

3.17	**Removal of waste items**			
3.17.1	Covering the ground with the protective foils	AXA		2.0
3.17.2	Survey of work hazards	AXA		2.0
3.17.3	Preparation of the lifting equipment (heat exchanger)	AXA		2.0
3.17.4	Preparation of tools and measuring equipment in the area	AXA		3.0
3.17.5	Preparation of the workgroup for the work	AXA		4.0
3.17.6	Preparation of waste containers	AXA		2.0
3.17.7	On site checking the specific procedure	AXA		4.0
3.17.8	Scheduling the manpower	AXA		2.0
3.17.9	Handling of small dismantled items < 30 kg to distance < 20 m	IDA	HDSI	2.0
3.17.10	Handling of heavy dismatled items > 30 kg to distance < 20 m	IDA	HDHI	4.0
3.17.11	Transfer of contaminated materials to WM facility	IDA	TRRW	1.0
3.17.12	Transfer of the cleared materials	IDA	TRCM	2.0
3.17.13	Removal of the lifting equipment (heat exchanger)	AXA		2.0
3.17.14	Removal of the protective foils	AXA		2.0
3.17.15	Removal of tools, equipment	AXA		2.0
3.17.16	Clearance procedures for the area and NCM to final disposal			3.0
3.17.17	Clearance Activities			7.0
3.17.18	Cordon off the area	AXA		3.0
3.17.19	Elaboration of the report on waste sampling and monitoring	PDA		2.0

List of Activities and Workers (6)

		Phase 4 - management and support			0.0
	4.1	Direct supervision, supports, management, safety, operation of the laboratory,	PDA		42.0
					0.0
		Phase 5 - elaboration of the subproject report			0.0
	5.1	Elaboration of the final report	PDA		9.0

Local Cost Rates (1)

Local Cost Rates
(in Philippine Pesos)

A. Labor rates per profession (per hour):

	Personal	Overhead
Manager	226	79
Senior Engineer	202	71
Graduate Engineer	175	61
Technician	152	53
Skilled Worker or Clerk	139	49
Auxiliary Worker	127	44

B. Contamination field measurement costs:

	Labor	Equipment	Time
Background (per measurement)	114	21	10 min
Surface γ or β scan, flat (per m^2)	114	21	10 min
Surface γ or β scan, pipe up to 2" dia (per m)	23	4	2 min
Surface γ or β scan, pipe up to 6" dia (per m)	57	10	5 min
(Pipe > 6" dia is to be considered as flat surface)			

Local Cost Rates (2)

C. **Sample-taking costs** (per sample):

	Labor	Consumables	Time
Smear	33	10	5 min
Soil	131	15	20 min

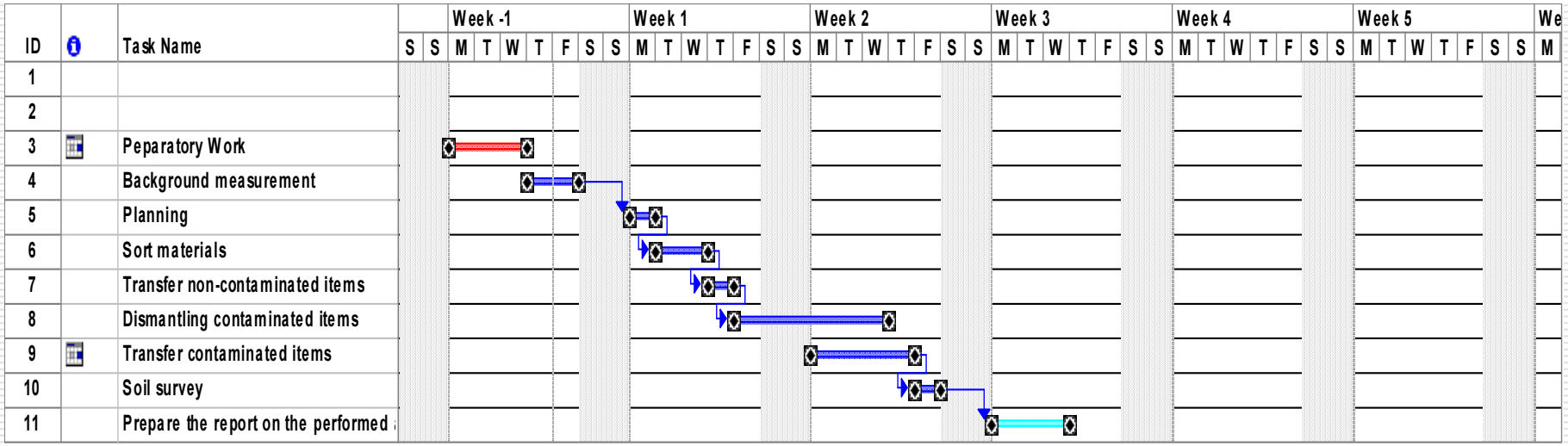
D. **Laboratory analysis costs** (per sample):

	Labor	Equipment	Time
Gamma counting	109	350	20 samples per day max
Smear counting	59	38	15 min per sample

E. **Equipment costs** (per hour):

Set of Personal Hand and Power Tools	50
2-ton Forklift	600
10-ton Crane	1800

Estimated Project Duration
- Level 1 Gantt Chart -



Part V:
Conclusions

Conclusions

- **Project duration:** **00 days**
- **Human resources:** **00 man-day**
- **Total cost:** **000 P**

Appendix I
Procedures Considered by WG #3 (text)

Procedure for Scanning Surfaces for Beta Contamination (1)

1. Personnel required

- One Technician or higher (to take measurements).
- One Skilled Worker or higher (to record measurements).

2. Equipment or tools required

- Calibrated portable rate meter with thin-window gas-proportional or scintillator detector.
- Beta check source.

Procedure for Scanning Surfaces for Beta Contamination (2)

3. Action steps

3.1 Step 1

- Perform pre-operational functional check according to the instrument's work instructions.

3.2 Step 2

- Switch the instrument ON and select the appropriate time constant (if possible) before entering suspected
- contamination area or approaching suspected contamination surface.

Procedure for Scanning Surfaces for Beta Contamination (3)

3.3 Step 3

- Measure and record background radiation level. Record actual lowest and highest values obtained.
- Recheck this level periodically to ensure that the detector has not become contaminated.

3.4 Step 4

- Using the audio response of the monitor, sequentially sweep the surface with the contamination monitor

Procedure for Scanning Surfaces for Beta Contamination (4)

3.4 Step 4 (cont'd)

- moving at a steady rate across the surface. Pass the detector slowly over the surface maintaining the distance
- as close to the surface as possible, nominally less than 1 cm. Speed of detector movement varies with
- radionuclide of concern and the required observation interval, but is typically one-half to one detector width per second.
- Traverse the surface at close intervals. Due to the short range of beta radiation and directional dependence of the detector, scanning intervals may overlap.

Procedure for Scanning Surfaces for Beta Contamination (5)

3.5 Step 5

- When audio response indicates a reading of significance, pause and take a meter reading.

3.6 Step 6

- Compare count rates to the established site action levels. Mark areas that meet or exceed action levels. Further
- investigation is necessary at these locations.

3.7 Step 7

- After the entire surface has been scanned, record on a map the dimensions of any areas of concern, and record
- locations and levels of ambient gamma radiation and elevated gamma radiation.

Procedure for Scanning Surfaces for Gamma Contamination (1)

1. Personnel required

- One Technician or higher (to take measurements).
- One Skilled Worker or higher (to record measurements).

2. Equipment or tools required

- Calibrated portable rate meter with NaI scintillator detector.
- Gamma check source.

Procedure for Scanning Surfaces for Gamma Contamination (2)

3 Action steps

3.1 Step 1

- Perform pre-operational functional check according to the instrument's work instructions.

3.2 Step 2

- Switch the instrument ON and select the appropriate time constant (if possible) before entering suspected
- Contamination area or approaching suspected contamination surface.

Procedure for Scanning Surfaces for Gamma Contamination (3)

3.3 Step 3

- Measure and record background radiation level. Record actual lowest and highest values obtained. Recheck
- This level periodically to ensure that the detector has not become contaminated.

3.4 Step 4

- Using the audio response of the monitor, sequentially sweep the surface with the contamination monitor

Procedure for Scanning Surfaces for Gamma Contamination (4)

3.4 Step 4 (cont'd)

- moving at a steady rate across the surface. Scanning is performed by swinging the detector in front of your
- body in a serpentine (S-pattern) manner while progressing.
- Maintain the detector at a distance of around 1 to 4 cm from the surface. Speed of detector movement is
- typically at 0.5 m/s, however this rate may be adjusted depending on expected detector response and the
- desired investigation level.

Procedure for Scanning Surfaces for Gamma Contamination (5)

3.5 Step 5

- When audio response indicates a reading of significance, pause and take a meter reading.

3.6 Step 6

- Compare count rates to the established site action levels. Mark areas that meet or exceed action levels. Further
- investigation is necessary at these locations.

3.7 Step 7

- After the entire surface has been scanned, record on a map the dimensions of any areas of concern, and record
- locations and levels of ambient gamma radiation and elevated gamma radiation.

Procedure for Smear Sampling for Removable Surface Contamination (1)

1. Personnel required

- One Skilled Worker or higher (to take samples).
- One Auxiliary Worker or higher (to record samples).

2. Equipment or tools required

- Smear papers (Whatman 50 or equivalent), 47mm diameter, pre-numbered.
- Cotton swabs.
- Zip-lock plastic envelopes.
- PPE gloves.
- Portable contamination monitor.

Procedure for Smear Sampling for Removable Surface Contamination (2)

3 Action steps

3.1 Step 1

- Put on the gloves.

3.2 Step 2

- Mark off a sampling area on the surface, 100 cm2 (10 cm x 10 cm) if possible. The sampling location should be flat, smooth and stationary.

3.3 Step 3

- Grab a smear paper by the edge, between the thumb and index finger. For small penetrations such as cracks or bolt holes, get a cotton swab instead.

Procedure for Smear Sampling for Removable Surface Contamination (3)

3.4 Step 4

- Carefully rub the smear medium over the marked area. Try not to apply so much pressure as to wear a hole or
- to roll the paper.

3.5 Step 5

- Use a portable contamination monitor to measure the level of contamination on the smear.
- Take care not to point the detector in the direction of any other source near the vicinity that may affect the reading .

Procedure for Smear Sampling for Removable Surface Contamination (4)

3.5 Step 5 (cont'd)

- If the background is too high for a measurement, either move to a lower background or use a special shielded smear sample holder to take the reading.
- Record the reading.

Procedure for Smear Sampling for Removable Surface Contamination (5)

3.6 Step 6

- Place the smear in an individual envelope.
- If a count higher than 250 cpm was detected, mark the smear envelope as such.
- Smears having a count greater than 2500 cpm should be sealed in an appropriate container and marked to
- minimize potential cross contamination.

3.7 Step 7

- Deliver the smears to the laboratory analyst.

Procedure for Shallow Soil Sampling (1)

1. Personnel required

- One Skilled Worker or higher (to take and record samples).
- One Auxiliary Worker or higher (to assist).

2. Equipment or tools required

- Soil core sampler.
- Rubber mallet.
- Plastic bottles with screw-on caps.
- PPE gloves.
- Portable contamination monitor.
- Clean water in squeeze bottle with nozzle.

Procedure for Shallow Soil Sampling (2)

3. Action steps

3.1 Step 1

- Put on the gloves.

3.2 Step 2

- Number and record the sample location in a map.

3.3 Step 3

- Use the portable contamination monitor to get a count reading on the soil surface. Record the count

Procedure for Shallow Soil Sampling (3)

3.4 Step 4

- Drive the core sampler vertically down on the soil to the 30 cm mark. If the sampler cannot be easily driven
- Down by hand, install the sampler's head protector and use a rubber mallet to tap the sampler in.

3.5 Step 5

- Withdraw the sampler, place its muzzle in an empty plastic bottle and use its bore rod to push the cored soil

Procedure for Shallow Soil Sampling (4)

3.5 Step 5 (cont'd)

- sample into the bottle. Do not contaminate the exterior of the bottle.
- Cap the bottle. Mark the bottle with the sample number.

3.6 Step 6

- Tap any remaining loose soil in the core sampler back into the hole in the ground. If the soil count in Step 2 was greater than 250 cpm, rinse the core sampler with clean water before taking another sample.

3.7 Step 7

- Deliver the sample bottles to the laboratory analyst.