Status of Implementation: PRR-I Decommissioning

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The Philippine Research Reactor I

- Open pool type research reactor, obtained under the USA Atoms for Peace Program
- Started operation in 1963 at original rated power of 1 MW
- Converted to TRIGA from 1984-1988
- Successfully tested but a leak at the pool liner prevented its operation
- On extended shutdown until 2005, when decision was taken to decommission

Policy basis for the decommissioning of PRR-I

- Recommendation by the PRR-I Strategic Plan Committee, submitted to the PNRI Director in 2002
- Endorsement by PNRI Management and approval by the DOST Secretary in November 2005. The PNRI accepts to host the R2D2 project.
- Creation of the PRR-I Decommissioning Plan Task Force through a PNRI Special Order in January 22, 2007.

Regulatory Framework

- PNRI Internal Regulatory Control Program an internal authorization process for PNRI nuclear and radiation facilities and laboratories, operationalized on January 20, 2004, with the creation of the RSSB. Regulations applied to external licensees also imposed on PNRI facilities.
- Issuance of PNRI Office Order No. 005 Series of 2008 on the subject Rules for the Authorization of Philippine Research Reactor-I
- Draft Law "Comprehensive Nuclear Regulation Act of 2007" creating an independent regulatory body also covers decommissioning, among others.

Legal and Regulatory Tenets

- Code of PNRI Regulations (CPR)- published set of regulations
  - CPR Part 2, *Licensing of Radioactive Material*. 16 July 1990
  - CPR Part 3, *Standards for Protection Against Radiation*. 6 September 2004
  - CPR Part 4, *Regulations for the Safe Transport of Radioactive Materials in the Philippines*. 25 October 2004

Legal and Regulatory Tenets, contd.

- Safety requirements to be applied to PRR-I decommissioning
  - Safety Series No. 115, *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources*. February 1996. STI/PUB/996
  - Safety Standards Series No. WS-R-2, *Predisposal Management of Radioactive Waste, including Decommissioning*. July 2000. STI/PUB/1089
  - Safety Standards Series No. WS-R-5, *Decommissioning of Facilities Using Radioactive Material*. October 2006. STI/PUB/1274

Other IAEA safety guides, technical reports and safety reports

- Safety Standards Series No. RS-G-1.7, *Application of the Concepts of Exclusion, Exemption and Clearance*. August 2004. STI/PUB/1202.
- Safety Standards Series No. WS-G-2.1, *Decommissioning of Nuclear Power Plants and Research Reactors*. October 1999. STI/PUB/1079.
- Safety Standards Series No. WS-G-5.1, *Release of Sites from Regulatory Control on Termination of Practices*. November 2006. STI/PUB/1244.
- Safety Standards Series No. WS-G-6.1, *Storage of Radioactive Waste*. November 2006. STI/PUB/1254.

Other IAEA safety guides, technical reports and safety reports

- Safety Reports Series No. 45, *Standard Format and Content for Safety Related Decommissioning Documents*. July 2005. STI/PUB/1214.
- Safety Reports Series No. 50, *Decommissioning Strategies for Facilities Using Radioactive Material*. March 2007. STI/PUB/1281.
- Technical Reports Series No. 389, *Radiological Characterization of Shut Down Nuclear Reactors for Decommissioning Purposes*. October 1998. STI/DOC/010/389.

Definition of Decommissioning (1)

Decommissioning is defined as those administrative and technical actions taken to allow the removal of some or all of the regulatory controls on the facility.

IAEA SRS 50 – Decommissioning strategies for facilities using radioactive materials, 2007

Definition of Decommissioning (2)

Decommission means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits--

- Release of the property for unrestricted use and termination of the license; or
- Release of the property under restricted conditions and termination of the license.

USNRC 10 CFR 20.1003

Decommissioning End-point

- Termination of the license proper to PRR-I
- Transition to one, appropriate to the operation of an exhibit area.

Site utilization

A permanent exhibit/museum on PRR-I, combined with a display area for information and technology dissemination featuring current topics on nuclear science and updates on PNRI R&D accomplishments.

Preparatory activities

Preparatory activities

- The Decommissioning Report has been started according to SRS 45.
  - Introduction
  - Chapter 1 - Reactor description - 2006
  - Chapter 2 – Hazards Characterization - 2006
  - Chapter 3 – Decommissioning Plan (Dismantling and decontamination) - 2008

A living record of the decommissioning of PRR-I. More chapters to be added or revisions made as work progresses and as policies are refined.

Preparatory activities

- Application for authorization to undertake decommissioning (on-going discussions with NRLSD).
- Setting up of sample preparation laboratory (nearing completion)
- Setting up and testing of counting equipment (completed)
- Removal of Co-60 sources (completed, only slightly irradiated fuel is left in reactor)

Preparatory activities

- Conduct of preliminary site survey and identification of hazards (radiation protection, ocular inspection, documentation), reporting of findings on potential hazards (from May 2008 to present, completed for the West and East Wings, nearly completed for the Reactor Bay)

Preparatory activities

- Formulation of actions to mitigate hazards and protect personnel who will undertake various jobs in the reactor – on-going
  - Radiological – remove contaminated loose objects, mark and control access to possibly contaminated areas, decontaminate as needed
  - Health - minimize dust, ensure ventilation, clear materials to minimize possible hazards from snakes
  - Conventional – dispose of chemical waste, clear broken glass, repair open circuitry, remove trip or bump hazards

Preparatory activities

- Repair of West Wing in view of its use for storage and management of materials in reactor – available budget for 2009
  - Installation of roofing
  - Demolition of damaged ceilings and walls in 2nd floor due to leaks
  - Rehabilitation of electrical installation
  - Testing of Dumb waiter for use in transfer of equipment and materials

Preparatory activities

- Planning for management of materials stored in the reactor
  - Formulate procedures for the monitoring and sorting of materials (contaminated or non-contaminated)
  - Formulate procedure for the classification of materials - useable/non-useable; equipment or parts/supplies
  - Formulate procedures for immediate disposal of conventional waste
  - Design storage zoning scheme
- Disposal of waste materials
- Orderly storage of materials from the reactor area at the West Wing while being processed for disposal or re-use

Preparatory activities

- Spent TRIGA Fuel
  - PNRI management decision on fate of spent fuel
    Done
  - Formulation of program for future utilization - use in experiments on Nuclear Physics and Engineering
  - Provisions for testing of fuel prior to use.
  - Establishment of security measures in the reactor during the period that the spent fuel will still be kept there
  - Construction of spent fuel storage facility (Assistance from ANSTO and NZ)
  - Transfer of spent fuel to new facility

Preparatory activities

- Assistance from USDOE, ANSTO, NZ
  - Design of spent fuel facility – with the assistance of ANSTO (design) and NZ (construction)
    - Review of design
    - Safety assessment
    - Formulation of security measures
    - Request for authorization
    - Request for additional funding via project proposal

Characterization Survey – commitment to complete in 2009 under the DOST GIA

- Chapter 2 on Hazards Characterization of the PRR-I Decommissioning report gives the basis for the Characterization survey
- Basic equipment to perform activity available with assistance from IAEA TC project
- Assistance may be required for supplementary analyses to be able to develop scaling factors and determine isotopic vectors
- Data will provide basis for D&D technologies to be used

Detailed Decommissioning Plan preparation

- Major elements of the Decommissioning Plan have been written (c/o Task Force Leader)
- Project Management is gathering together these elements to prepare an "initial" decommissioning plan. An action plan delineating activities that need to be undertaken, including options to be considered for decision making.
- Delineates responsibilities within the PNRI
  - Characterization and D&D – Task Force
  - Radioactive Waste Management c/o the RWMF but Task Force packages the waste
  - Management of materials stored in the reactor – NSTD with FAD
- Safety assessment and cost estimation
- "Initial" Decommissioning Plan to be fleshed up as policies are firmed up and as information is generated.

Decontamination and Dismantling

- Chapter 3 (Decommissioning Plan) on D&D technologies will be updated based on the results of the Characterization Survey

Decontamination and Dismantling

- PNRI is seriously considering an additional option of not dismantling the biological shield if safety assessment indicates minimal radiological impacts. This will take into consideration
  - IAEA SRS WS-G-5.1 Release of sites from Regulatory Control after Termination of Practices
  - IAEA SRS RS-G-1.7 Applications of the Concepts of Exemption, Exclusion and Clearance

Radioactive waste management

- Segregation and packaging of waste according to PNRI RWMF waste acceptance criteria
- Transport to RWMF for temporary storage (to be expanded to accommodate waste from reactor decommissioning)
- On-going planning to design waste containers

Termination of license proper to PRR-I

- Verification survey to ensure that radioactivity levels are within safe limits
- Completion of the Decommissioning report
- Application for termination of PRR-I license and transition to one (if necessary) consistent with the operation of the Exhibit area

Results of preliminary survey

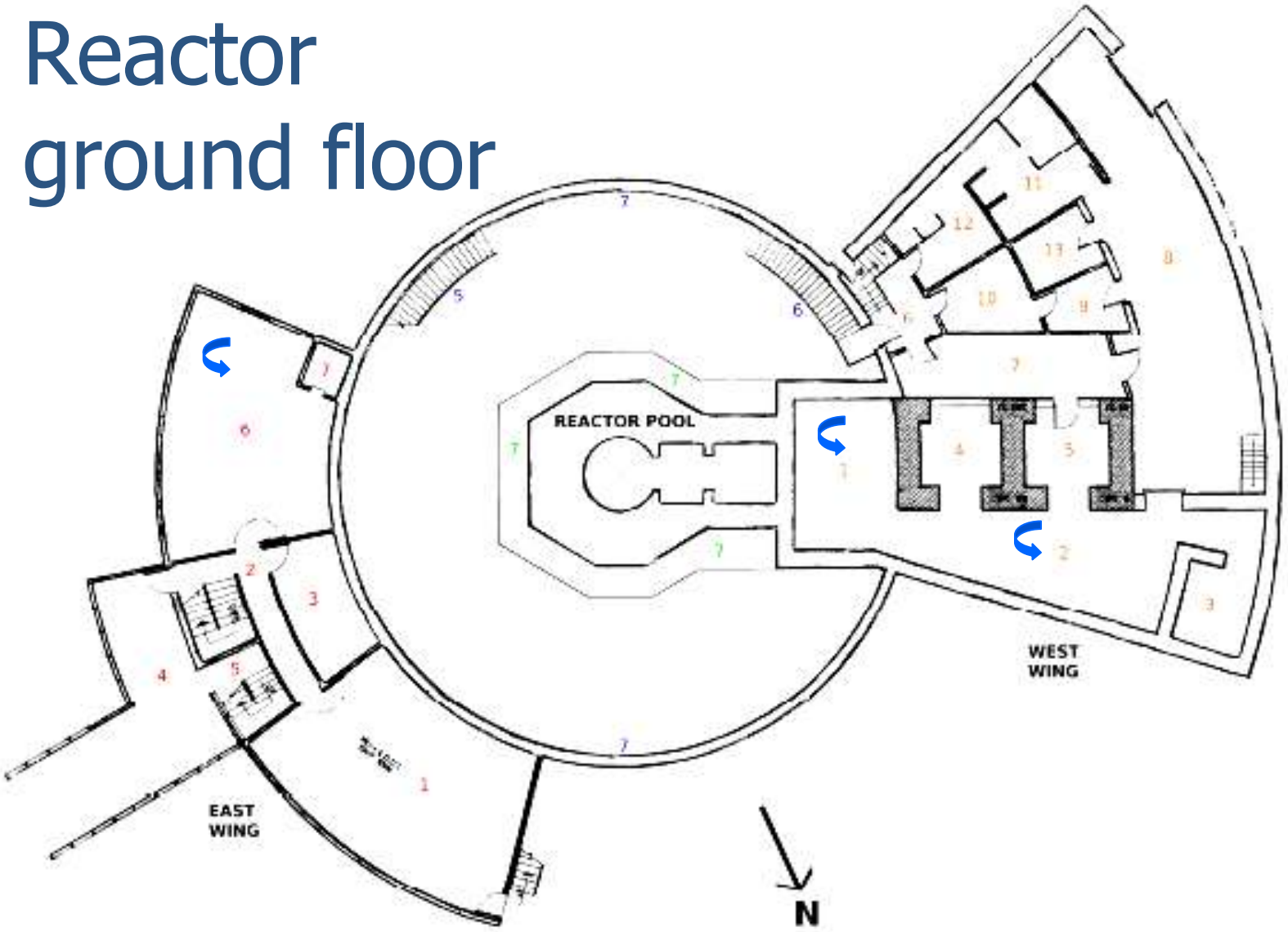
Purpose: To identify potential hazards in reactor area

Summary of findings

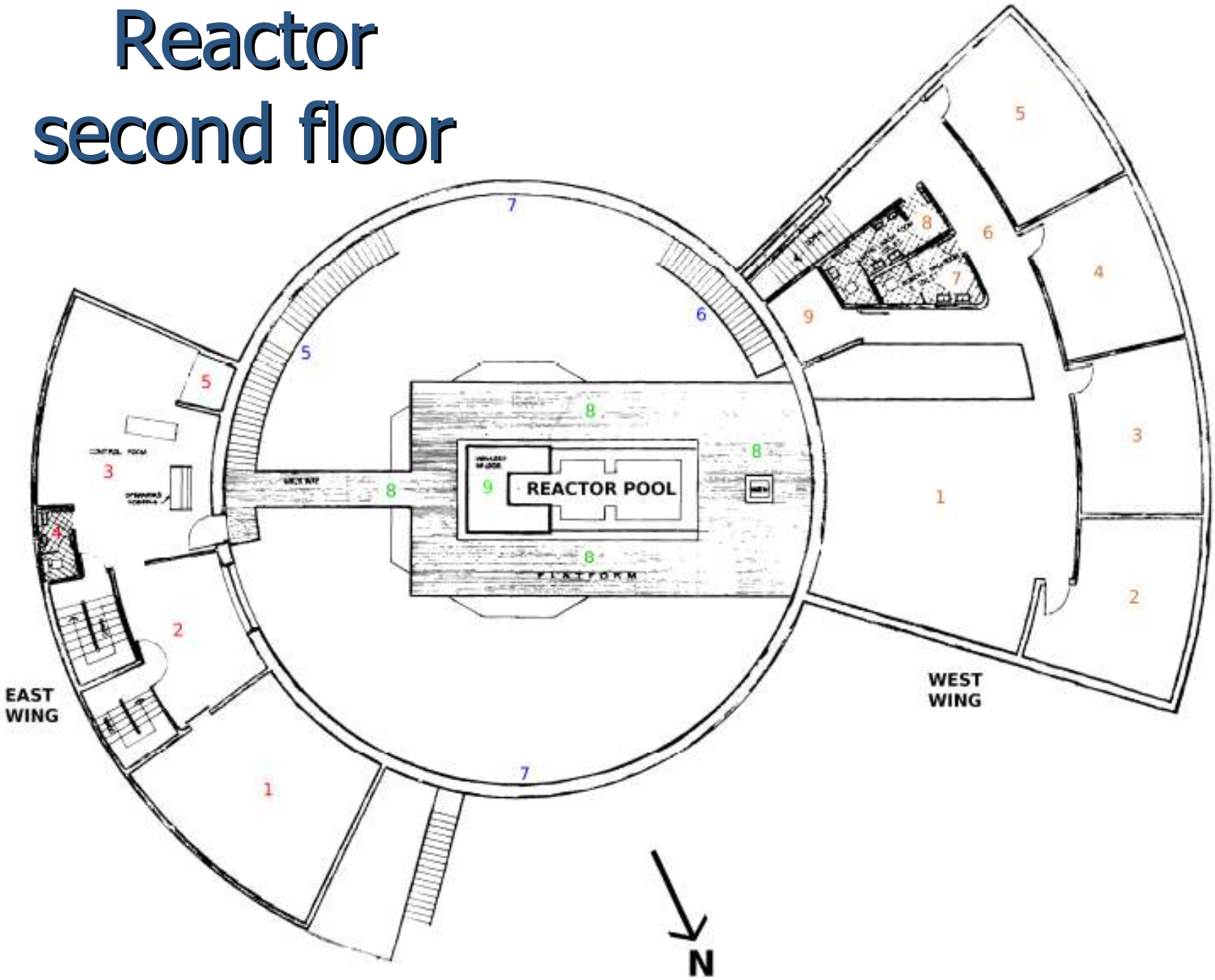
- At the West only 2 stray contaminated objects were found.
- At the East Wing and Reactor Bay, some localized contamination was found.
- Radioactivity levels were low and did not contribute significantly to ambient dose.
- Conventional and chemical waste in many areas
- Other hazards – dust, open circuitry, trip and bump, etc.

The survey team

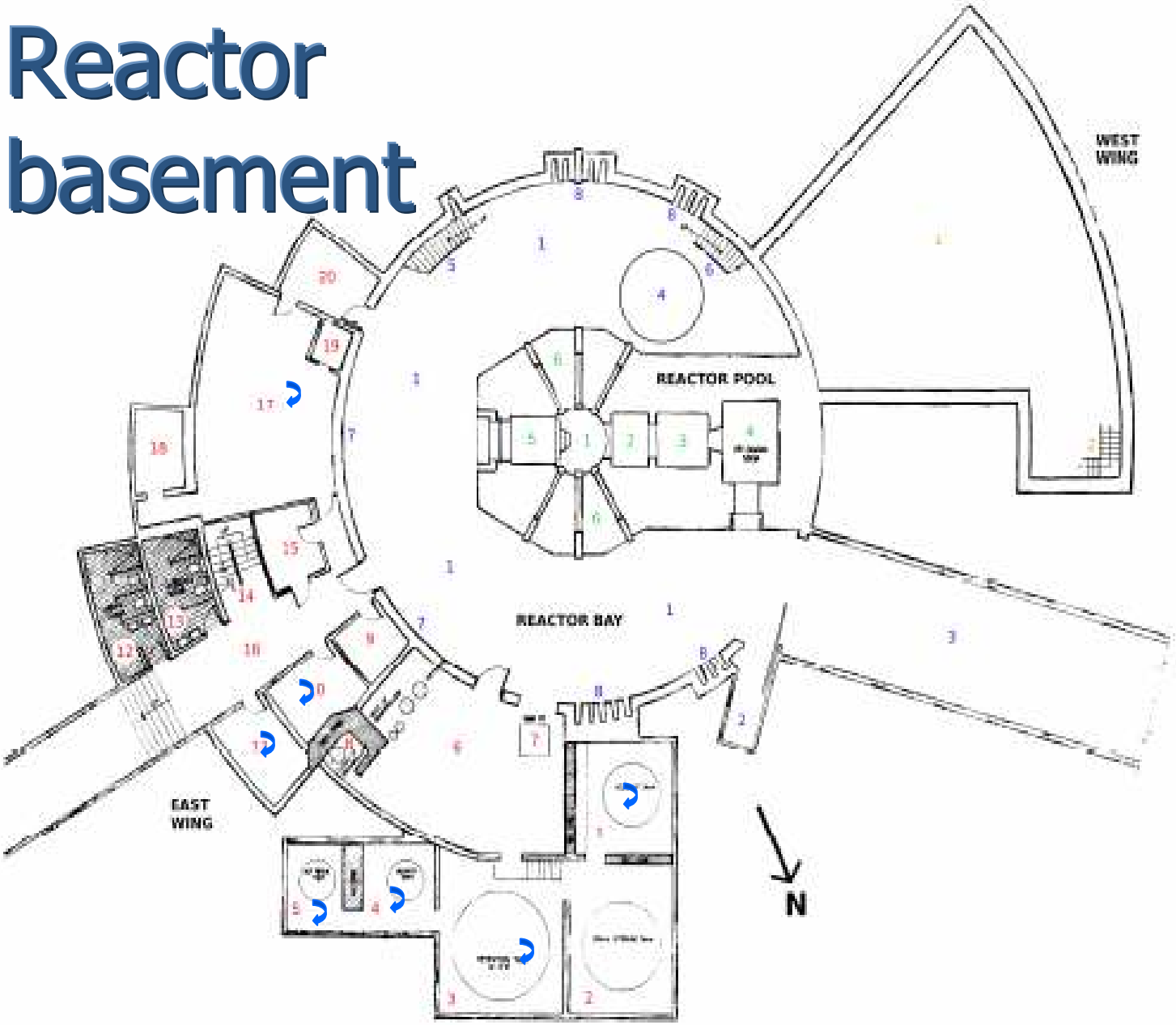
Reactor ground floor



Reactor second floor



Reactor basement



Sample of survey report: E0-11

Site Description

Condition of the area

The room was used for storage of different materials. During the survey, the location is inaccessible because of the presence of several drums containing resins, tables, instrument casings, lighting fixtures and scrap metals among others. The flooring is made of linoleum which has now become brittle. Some of the countertops and hanging cabinets contain incandescent lighting, check sources, and swipe samples. Several shards of broken glass are scattered on the floor

Sample of survey report E0-11

- Presence of hazards
  - Dusts
  - Contaminated floor and cabinets
  - Puncture & injuries from broken glass
  - Tripping & bumps from scrap metals and heavy drums
  - Lifting of heavy drums

Sample of survey report E0-11

Protective actions

- Protective clothing and devices : Laboratory gown or overalls, dust masks, gloves for handling contaminated items, safety boots, heavy duty gloves
- Provisions for moving heavy materials

Sample of survey report E0-11

- *Date of Monitoring*: 11 September 2008

Instruments Used:

- Ludlum #D1 SN: PR257579
- Canberra Radiagem #2 Survey meter & SN: 0103
- NE PCM 5/1 SN: 1986

Net ambient dose rate summary

Background	Dose rate
Ground level (mSv/hr)	**0.20**
Waist level (mSv/hr)	**0.20**

Sample of Survey report E0-11

Location / Item	Contamination Level			
	$\beta+\gamma$ (Bq/cm^2)	removable	Ref. source	Surface Doserate (uSv/hr)
Floor area behind the door	1.03	-none-	Cs-137	bkg
Lowest portion of the cabinet at the left-side of the door entrance	2.0	-none-	Cs-137	bkg
Hanging cabinets at the left side of the room	1.5	-none-	Cs-137	bkg
Contaminated swipe samples and check sources at one of the hanging cabinets				

Schedules-1

Activity	Responsible group	Date started	Target date
Application for authorization to decommission PRR-I & submission preliminary DP	RO		April 15, 2009
Preliminary survey	Field survey team (FST)	May 08	April 09
Planning for hazards mitigation	RHSO, FST	April 09	EO April 2009
Repair of West Wing – to be contracted out	PM/ FAD/ RO	July 09	Sept 09
Sample collection at Reactor Bay	Sampling team (ST), FST	May or June 09	continuing

Schedules -2

Activity	Responsible group	Date started	Target date
Sample collection at Reactor Bay	Sampling team (ST), FST	May or June 09	continuing
Analysis	Analytical team	May 09	November 09
Data analysis	DTF	As data generated	November 09
Safety assessments related to D&D options for biological shield	Safety assessment group	As soon as data available	1st quarter 2010
Recommendations to PNRI management	DTF	After safety assessment	March 2010

Schedules -3

Activity	Responsible group	Date started	Target date
Decontamination as needed in East Wing/ Reactor Bay	DTF	2009	TBD
D&D as needed reactor components	DTF/ contractors	TBD	
D&D biological shield – if option selected	DTF/ contractors		
Verification survey	FST/ST/AT		
Completion of Decommissioning report	DTF		
Application for termination of license	DTF/PM		

Collateral costs in PRR-I Decommissioning

Cost elements

- Activity dependent costs – associated with performance of decommissioning activities (decontamination, removal of equipment, packaging of waste, transport to RWMF facility)
- Period dependent costs – associated with project duration (engineering, project management, dismantling management, licensing, health and safety, security, energy, quality assurance)

Based on IAEA TECDOC 1476 – Financial aspects of decommissioning

Cost elements

- Collateral costs – for special items not included in first 2 categories (construction or dismantling equipment, site preparation, insurance, property taxes, health physics supplies, liquid radioactive waste processing, independent verification surveys)
- Contingency costs – provisions for unforeseeable elements of cost e.g. increasing costs, inflation

Collateral cost items related to PRR-I decommissioning

- Site preparation – removal of materials stored in the reactor, particularly areas related to reactor operations
  - Repair of West Wing for use as temporary storage
  - Labor for removal and orderly storage of materials
  - Chemical waste management and disposal costs
  - Fabrication (and later, dismantling) of structures such as scaffolding, tent to prevent the spread of dust, other temp. structures
- Procurement of dismantling equipment
- LGU permits as needed

Collateral cost items related to PRR-I decommissioning

- Construction of trenches for radwaste (in case it is decided to dismantle the biological shield)
- Construction of spent fuel facility
- Procurement of protective clothing and devices; other Health Physics equipment
- Consultancy
- Training of personnel

Thank you for your attention

Mabuhay!