

ATAL-BELGOPROCESS JOINT VENTURE

Contract No. EP/SP/40/02

Low Level Radioactive Waste Storage Facility at Siu A Chau

**Sixth Environmental Monitoring and Audit Report
(Operation Phase)**

Version 2.0

February 2006

Certified By _____



(Environmental Team Leader)

REMARKS:

The information supplied and contained within this report is, to the best of our knowledge, correct at the time of printing.

The Environmental Team Leader accepts no responsibility for changes made to this report by third parties.

Dr. John K.C. Leung
Department of Physics, The University of Hong Kong
Pokfulam Road, Hong Kong.

Tel: +852 2859 2858 Fax: +852 2471 8888

E-mail: jkcleung@hku.hk

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION.....	2
BACKGROUND	2
PURPOSE OF THE REPORT	2
2. MONITORING RESULTS.....	3
AMBIENT γ DOSE RATES	5
SOIL	5
SAND.....	5
GRASS	5
SEA WATER.....	5
MARINE ORGANISMS.....	5
AIRBORNE PARTICULATES	5
3. REPORT ON ELEVATED ENVIRONMENTAL RADIATION BACKGROUND..	6
4. REPORT ON NON-COMPLIANCE	7
DOSE FOR RADIATION WORKERS	7
DOSE RATES AT UN-CONTROLLED AREAS.....	7
LIQUID EFFLUENT DISCHARGE	7
AIRBORNE EFFLUENT DISCHARGE	7
5. RESULT OF ENVIRONMENTAL COMPLIANCE AUDITS	8
APPENDIX 1	9
LIMIT LEVEL AND ACTION LEVEL	9
INVESTIGATION LEVEL	9

LIST OF TABLES

Table A1.1 Limit Levels for Non-compliance and Action Levels

Table A1.2 Investigation Levels for Environmental Samples

LIST OF FIGURES

Figure 2.1 Locations of the Sampling Sites

EXECUTIVE SUMMARY

This report presents the results of the radiological monitoring work performed between December 14, 2005 and January 17, 2006. The sampling was done on January 17, 2006.

The LRWF is operating satisfactorily and the release of radon is now under control.

No exceedance of Investigation Level was observed.

No non-compliance with the environmental performance requirement was observed.

1. INTRODUCTION

Background

- 1.1 Various industrial, educational and medical facilities in Hong Kong have, for a number of years, used radioactive materials and generated radioactive waste. Most of the existing waste arisings are stored in disused air raid tunnels close to Queen's Road East in Wan Chai. Other arisings are stored temporarily (although in some cases for several years) at the point of use in educational institutions or hospitals.
- 1.2 A consultancy study in 1995 concluded that Siu A Chau was a suitable location for a purpose-built storage facility to which all waste will be transported, placed in stainless steel drums and stored.
- 1.3 In July 2003 ATAL-Belgoprocess Joint Venture Limited (ABJV) was awarded a contract to design, construct, and operate the LRWF at Siu A Chau. Thereafter, the ABJV will transfer the waste management skills for this Facility to Hong Kong.
- 1.4 The LRWF was designed to have a storage vault that can initially store 260 drums of waste, each drum of 275 litres net capacity. The building will also contain facilities for waste reception and repackaging waste, and administering the process. A jetty will be built to provide marine access to the Facility.
- 1.5 The Facility is equipped with various radiation monitors inside the building specially installed for detecting all possible leakage of effluents from the building.
- 1.6 However, it is possible that minute activities may escape from detection and enter the biosphere, or an unexpected incidence would have resulted in a significant release of radionuclide from the Facility. It is one of the objectives of this environmental monitoring scheme to monitor whether in the long-term, the operation of the Facility will cause deterioration to the environment.

Purpose of the Report

- 1.7 This is the sixth EM&A (Operation Phase) report, which is also the fifth report on measurement results of environmental samples taken after the commencement of operation of the LRWF on July 28, 2005. This report covers the monitoring period from December 14, 2005 to January 17, 2006.
- 1.8 The requirements of the operation phase monitoring and audit; monitoring scheme and monitoring equipment and procedures have been fully described in the First EM&A (Operation Phase) Report. Please refer to that report for reference.
- 1.9 This report also covers the monitoring of personnel doses, the non-active areas of the Facility and the liquid and gaseous effluents.

2. MONITORING RESULTS

- 2.1 The sampling scheme remained unchanged except only 1 fish was caught. 15 in-situ ambient γ dose rates were measured. 3 soil samples; 3 sea sediment samples; 3 grass samples; 8 seawater samples from 4 locations at two depths; 1 kg of sea snails and 3 airborne particulate samples were collected and analysed as in previous monitoring. **Figure 2.1** shows the locations for taking various samples.
- 2.2 Ambient γ dose rates were taken at exactly the same locations and would give a true picture of the variation of the radiation environment if there were any.
- 2.3 Soil and grass samples were collected at more or less the same place as for the baseline. Since we need fresh surface soils that would have stored information of fallout since the commencement of the operation, the sampling sites shifted a little bit every time.
- 2.4 The uncertainties of the measurement results are given as standard deviation (SD) or standard uncertainty (SU). SD is given for individual sample and is calculated according to the number of counts recorded and assuming a normal distribution for the counts. SU is reported for each group of samples and it takes into account of the variance between samples. Please refer to the First EM&A Report (Operation Phase) for details.

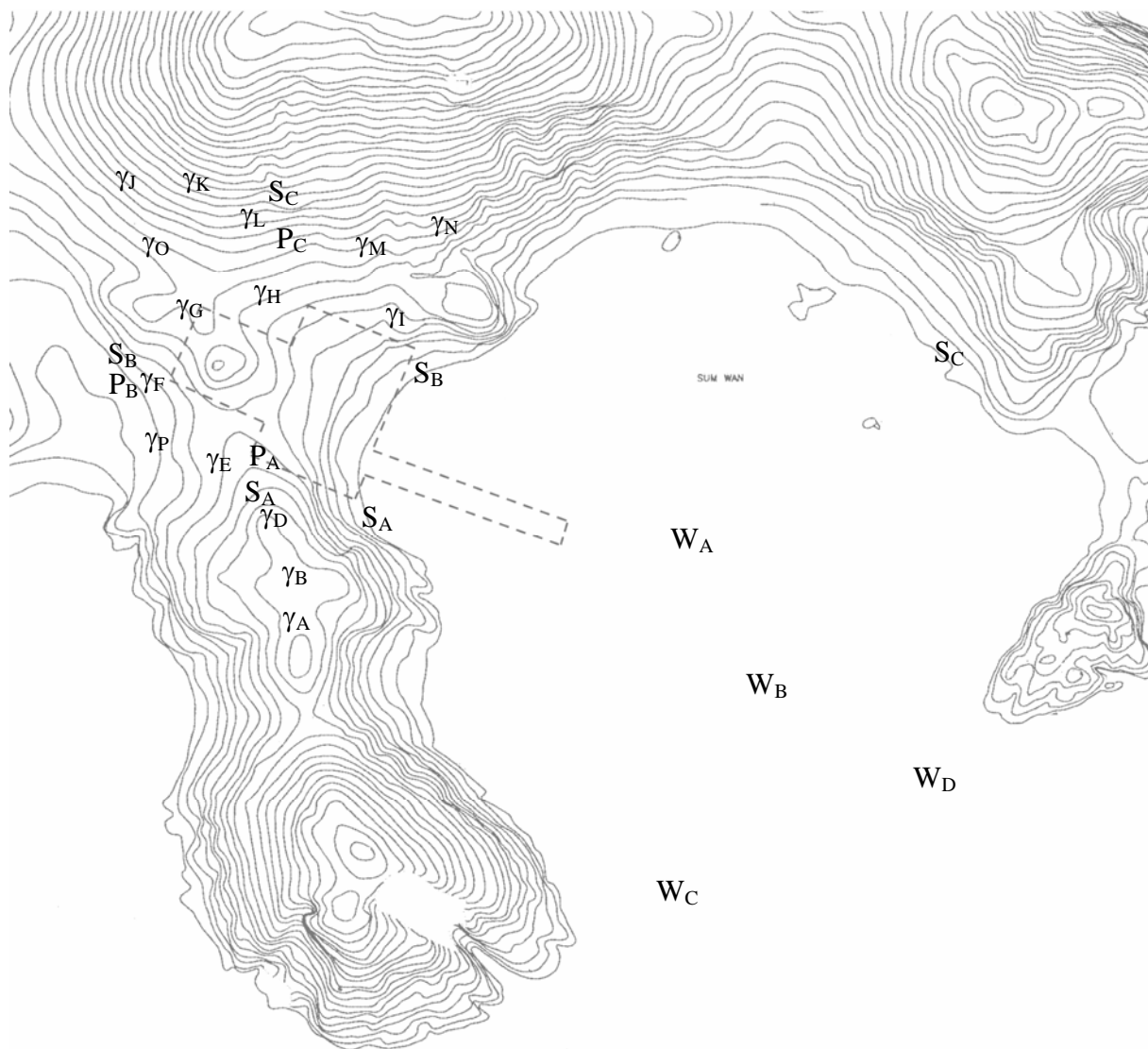


Fig. 2.1 Locations of the Sampling Sites

(γ : Ambient gamma dose rate; S: Soil or Sand; W: Water; P: Air particulates)
(Grass sampling sites are the same as soil sampling sites)

Ambient γ Dose Rates

- 2.5 All measurement results are within normal fluctuation of the baseline level and the overall average value has not changed during the monitoring period.

Soil

- 2.6 Soil samples were collected at 3 locations only, all from the undisturbed areas.
- 2.7 All measurement results were within normal fluctuation range.

Sand

- 2.8 Sand sample C has again recorded a higher content of ^{226}Ra and ^{232}Th since the November sampling. However, no exceedance of Investigation Level is observed.

Grass

- 2.9 Grass samples were collected in locations near to the soil samples. The γ -spectra are identical to the background of the γ spectrometer and do not reveal the presence of any significant γ -emitting radionuclides.
- 2.10 All gross α and β activities are within the normal fluctuation of the baseline values.

Sea Water

- 2.11 The same 4 locations were chosen to collect the water samples at 2 depths.
- 2.12 There is no sign of presence of γ emitters and all gross α and β activities are comparable to the baseline levels.

Marine Organisms

- 2.13 Only one fish was caught at the jetty this time. However the fish is big enough for preparing 3 samples, hence 3 measurement data were obtained.
- 2.14 Sea snails were collected randomly along the shores.
- 2.15 All gross α and β activities are comparable to the baseline levels.

Airborne Particulates

- 2.16 The sampling period was from December 14, 2005 to January 17, 2006.
- 2.17 A small amount of both α and β activity was detected in Location A, which is still below the background activity in the cloth. The activities in the other 2 locations are similar to the baseline values.
- 2.18 The collected activities have been significantly reduced from the previous two monitorings.

3. REPORT ON ELEVATED ENVIRONMENTAL RADIATION BACKGROUND

- 3.1 The Investigation Levels for environmental samples have been established and they are given in Appendix 1. The relevant action plan is given in the First EM&A Report (Operation Phase).
- 3.2 The ambient γ dose-rate at location L has shown a larger fluctuation than those at other locations. This was due to the difficulty in placing the γ dose-ratemeter at the same physical location because of the sloppy terrain.
- 3.3 The passive cloth sampler at Location A recorded minute airborne activities. It is noted that the activity is now much lower than the previous measurement results.
- 3.4 All other measurement results are more or less the same as those reported in previous EM&A Report.

4. REPORT ON NON-COMPLIANCE

4.1 The Action Level and Limit Level (A/L Levels) for non-compliance have been established and they are given in Appendix 1 for easy reference. The relevant Event and Action Plan have been developed. Please refer to the First EM&A Report (Operation Phase) for details.

Dose for Radiation Workers

4.2 There was no record of exceeding the A/L Levels as recorded by TLDs.

Dose Rates at Un-controlled Areas

4.3 No exceedance of the A/L Levels was observed.

Liquid Effluent Discharge

4.4 There was no liquid effluent discharged during the monitoring period.

Airborne Effluent Discharge

4.5 The total radon released during the monitoring period was estimated to be 5.4×10^8 Bq/month, which is below the A/L Levels.

4.6 The discharged α and β activities were also below the A/L Levels.

4.7 The total airborne effluent discharge was below the A/L Levels.

5. RESULT OF ENVIRONMENTAL COMPLIANCE AUDITS

- 5.1 Radon emission is now under control. But it is anticipated that the situation will get worse when Batch B wastes and hospital wastes are transported to the LRWF in the near future. This issue was further discussed in the Second Operation Meeting and it was agreed that a comprehensive survey of the leaking drums has to be carried out and remedial actions for suppressing radon released from these drums have to be done. These works are being done.
- 5.2 A compliance audit was conducted on January 17, 2006 and no non-compliance was noted.
- 5.3 No compliant was received during the period.

APPENDIX 1

Limit Level and Action Level

The Limit Levels for non-compliance with the Environmental Performance Requirements during the Operation are shown in **Table A1-1**.

Table A1-1 Limit Levels for Non-compliance and Action Levels

Environmental Performance Requirements	Limit Levels	Action Levels (3/10th of Limit Levels)
Dose for radiation workers	1.67 mSv per month	0.5 mSv per month
Dose rate at un-controlled areas	1 µSv per hour	0.3 µSv per hour
Liquid effluent discharge	10 ALI per month	3 ALI per month
Airborne effluent discharge	10 ALI per month	3 ALI per month

Investigation Level

With the help of all the internal monitoring, it is unlikely that the effluents will cause any observable increase in the radiation levels in the vicinity of the Facility under normal operation. It is also not anticipated that any significant quantity of the radioactive wastes would be released to the environment under even the most severe natural disasters. Nevertheless when the environmental samples are found to have radioactivities higher than the normal fluctuation of the established baseline levels, some investigation has to be initiated. The levels that trigger the investigation are called investigation levels and they are given in **Table A1.2**.

Table A1.2 Investigation Levels for Environmental Samples

Environmental Samples		Investigation Levels	
Ambient γ dose rate ($\mu\text{Sv h}^{-1}$)	A	0.23	3 × SD of individual baseline dose rate
	B	0.25	
	D	0.27	
	E	0.29	
	F	0.28	
	G	0.27	
	H	0.31	
	I	0.32	
	J	0.24	
	K	0.32	

	L	0.25	
	M	0.31	
	N	0.29	
	O	0.24	
	P	0.29	
Soil (Bq kg ⁻¹)	²²⁶ Ra	91.7	3 × SU of baseline samples
	²²⁸ Th	128.5	
	⁴⁰ K	1497	
	¹³⁷ Cs	1.36	
	Other γ emitters		Occurrence in any quantities
Sand (Bq kg ⁻¹)	²²⁶ Ra	32.0	3 × SU of baseline samples
	²²⁸ Th	38.1	
	⁴⁰ K	894	
	Other γ emitters		
Grass (Bq g ⁻¹)	Gross α	0.22	3 × SU of baseline samples
	Gross β	0.43	
	γ emitters not found in baseline		
Sea water (Bq L ⁻¹)	Gross α	1.52	3 × SU of baseline samples
	Gross β	9.3	
	γ emitters not found in baseline		
Fish (Bq g ⁻¹)	Gross α	0.021	3 × SU of baseline samples
	Gross β	0.076	
Sea snails (Bq g ⁻¹)	Gross α	0.048	3 × SU of baseline samples
	Gross β	0.076	
Airborne particulates (cpm)	Gross α		Occurrence in any quantities
	Gross β		

- SD is the standard deviation of a single sample.

- SU is standard uncertainty of the sample group.