ATAL-BELGOPROCESS JOINT VENTURE

Contract No. EP/SP/40/02

Low Level Radioactive Waste Storage Facility at Siu A Chau

Fifth Environmental Monitoring and Audit Report (Operation Phase)

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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.

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EXECUTIVE SUMMARY

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

Slightly higher activities were detected in sand sample C again. Since the gaseous effluent of α and β-emitters (except ^{222}Rna and its short-lived progenies) during the period was negligible as revealed by the Monthly Operation Reports and that there was no liquid discharge during the same period, it can be concluded that the elevated activities in the sand samples were not attributed to the operation of the LRWF but were rather influenced by natural environmental factors.

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 fifth EM&A (Operation Phase) report, which is also the fourth 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 November 17 to December 14, 2005.

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. 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; 3 fish; 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.

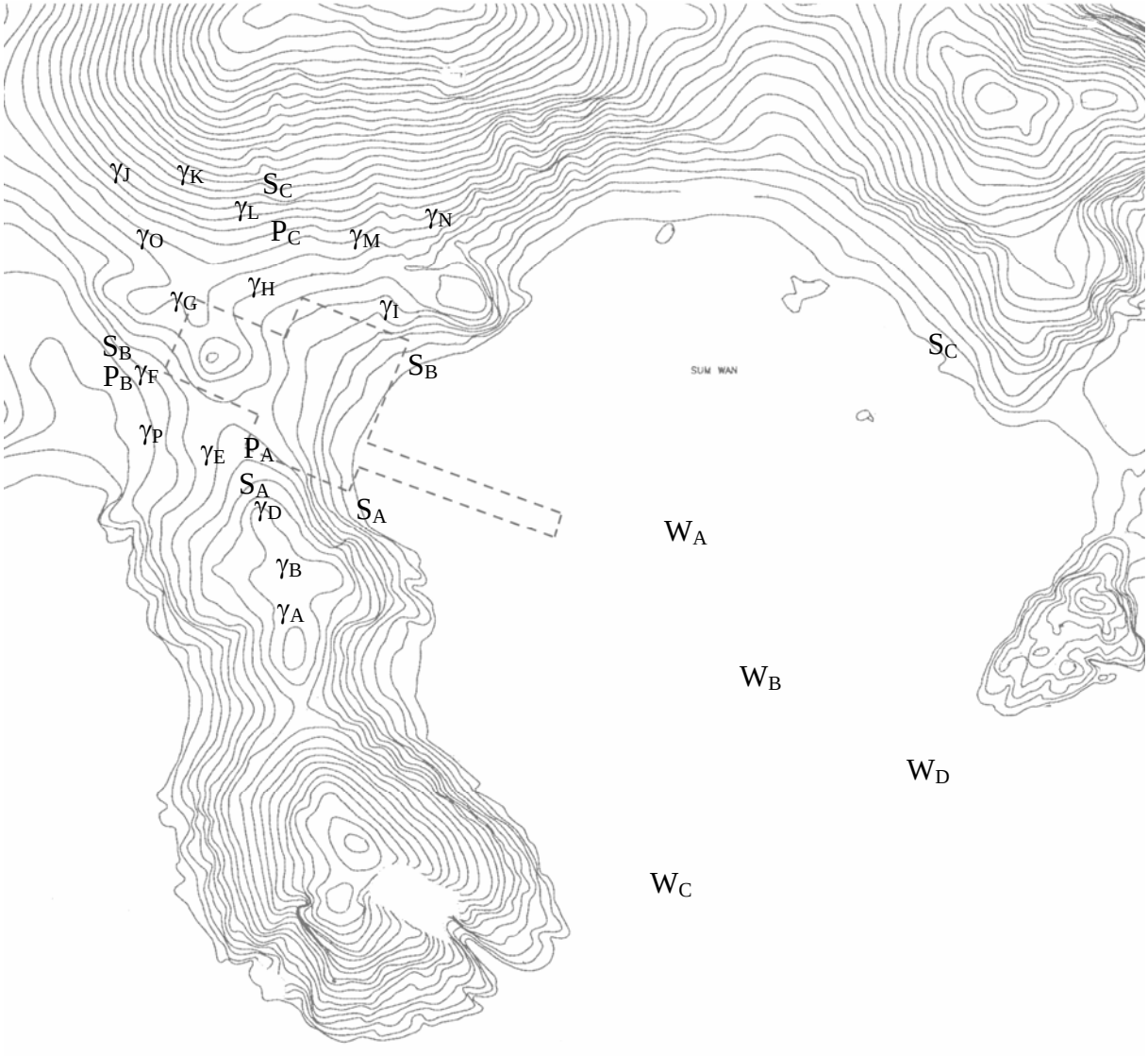

Fig. 2.1 Locations of the Sampling Sites

(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 measured γ dose-rates are below the Investigation Levels. It is also noted that 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. These locations correspond to the passive air sampler locations which aim to detect dispersion of effluent leakages, if any, in the prevailing wind directions.

2.7 All measurements were within the normal fluctuation and there was no exceedance of the Investigation Levels.

Sand

2.8 As usual, three sand samples were collected. Two from the beaches on both sides of the jetty and one from the north-eastern shore.

2.9 Same as last time, there is a higher level of both ^{226}Ra and ^{228}Th content in sand sample C though they are below the Investigation Level.

Grass

2.10 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.

2.11 All gross α and β activities are within the normal fluctuation of the baseline values.

Sea Water

2.12 The same 4 locations were chosen to collect the water samples at 2 depths.

2.13 There is no sign of presence of γ emitters and all activities are comparable to the baseline levels.

Marine Organisms

2.14 Three fish were caught at the jetty and sea snails were collected randomly along the shores.

2.15 All gross αand β activities are comparable to the baseline levels.

Airborne Particulates

2.16 The sampling period was from November 16, 2005 to December 14, 2005.

2.17 A small amount of both α and β activity are detected in all three locations. However, most of the readings have dropped when compared to last time.

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 passive cloth samplers recorded minute airborne activities.

3.3 Both the ^{226}Ra and ^{228}Th contents in sand sample C have recorded a noticeable increase. However they are still below the Investigation Levels.

3.4 All other measurement results are more or less the same as those reported in previous EM&A Reports.

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 4.4×10^8 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.

5.2 Though a higher radon emission rate is anticipated, it's important to point out that it won't cause any significant adverse effect to the environment. This is because radon is a naturally occurring radionuclide and it is continuously being emitted to the atmosphere in even greater quantity from soils and building structures.

5.3 Some slightly higher activities are observed in sand samples and in the cloth samplers. But because the gaseous effluent of α- and β-emitters (except ^{222}Rn and its short-lived progenies) since operation of the LRWF was negligible as revealed by the Monthly Operation Reports and that there was no liquid discharge during the same period, it can be concluded that the elevated activities in these samples were not attributed to the operation of the LRWF but were rather influenced by natural environmental factors.

5.4 A compliance audit was conducted on December 16, 2005 and no non-compliance was noted.

5.5 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 ($3/10^{th}$ 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 ($\mu Sv\ h^{-1}$)	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 M N O P	0.25 0.31 0.29 0.24 0.29	
Soil (Bq kg^{-1})	^{226}Ra ^{228}Th ^{40}K ^{137}Cs	91.7 128.5 1497 1.36	3 × SU of baseline samples
	Other γ emitters		Occurrence in any quantities
Sand (Bq kg^{-1})	^{226}Ra ^{228}Th ^{40}K	32.0 38.1 894	3 × SU of baseline samples
	Other γ emitters		Occurrence in any quantities
Grass (Bq g^{-1})	Gross α Gross β	0.22 0.43	3 × SU of baseline samples
	γ emitters not found in baseline		Occurrence in any quantities
Sea water (Bq L^{-1})	Gross α Gross β	1.52 9.3	3 × SU of baseline samples
	γ emitters not found in baseline		Occurrence in any quantities
Fish (Bq g^{-1})	Gross α Gross β	0.021 0.076	3 × SU of baseline samples
Sea snails (Bq g^{-1})	Gross α Gross β	0.048 0.076	3 × SU of baseline samples
Airborne particulates (cpm)	Gross α Gross β		Occurrence in any quantities

- SD is the standard deviation of a single sample.
- SU is standard uncertainty of the sample group.