

Project Profile

**Decommissioning and Disposal of
a Clinical Waste Incinerator
at Tang Shiu Kin Hospital**

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1. Basic Information

1.1 Project Title

Decommissioning and disposal of a clinical waste incinerator (combustion furnace with the entire flue) at Tang Shiu Kin Hospital.

1.2 Purpose and Nature of the Project

As part of the works programme to remodel Tang Shiu Kin Hospital into an ambulatory care centre, an existing incinerator will be decommissioned and removed.

1.3 Name of Project Proponent

Architectural Services Department

1.4 Location and Scale of Project

The existing Tang Shiu Kin Hospital is situated along Queens Road East, Wan Chai. Figure 1-1 shows the location of the hospital and its surrounding landuses.

The incinerator to be demolished is located at the incinerator room on the sub-lower-ground floor of the hospital. Location of the incinerator room is as shown in Figure 1-2. The incinerator flue leaves the incinerator room and runs horizontally through the boiler room until reaching the partitioned area within the pump room on the same floor. The flue then runs vertically to the roof through the partitioned area within the M/E room on each floor (lower ground floor to the 7th floor) of the hospital building. The location of incinerator flue on each floor from lower ground floor to the 7th floor is contained in Appendix A.

In order to allow the remodelling programme to proceed as scheduled, the existing clinical waste incinerator at Tang Shiu Kin Hospital has to be demolished. The clinical waste incinerator to be decommissioned shall include the combustion furnace and its associated panels, and the entire flue section up to and above the roof level of the hospital. The incinerator is mainly constructed with metal except the interior of the incinerator furnace which is lined with fire bricks.

The incinerator has an internal furnace capacity of about 1m³. The incinerator was put into service since October 1989 and ceased operation in January 2000. The normal hours of operation during the period was about 4 hours per day and 5 days per week. Average quantity of waste incinerated per day was in the order of 40 kg. Maintenance and repairing of the incinerator were provided by the E&M staff during its operational period. No recorded accidents occurred during the operations of the incinerator.

Waste generated from the operation of the hospital incinerated during the period include wastes generated from laboratories, tissues or organs or other wastes from the Operating Theatre, dressing with blood waste from A&E Department or wards, and unused drug waste.

1.5 Number and Type of Designated Project to be covered by the project profile

Under item 3 in Part II, Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance, decommissioning of the clinical waste incinerator at Tang Shiu Kin Hospital is classified as a designated project. Therefore, an Environmental Permit must be obtained before conducting the decommissioning works.

1.6 Name and Telephone Number of Contact Person(s)

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2. Outline of Planning and Implementation Programme

It was planned to commence the decommissioning of the incinerator in early 2003 in order to allow the overall remodelling works to be completed as scheduled.

2.1 Clinical Waste Incinerator Decommissioning Programme

A tentative programme for the decommissioning of the clinical waste incinerator shall be as follows:

Procedures estimated duration	Time required
Site Preparation and Containment Construction (section 3.2.1)	1 day
Preliminary site decontamination	0.5 day
Construction of containment	5 days
Smoke test (Section 3.2.2)	0.5 day
Removal (Section 3.2.3)	
Removal and decontamination of top vertical section of the incinerator flue	4 days
Removal and decontamination of the clinical waste incinerator	1 day
Disposal (Section 3.2.4)	Within 1 day from obtaining disposal permit

3. Possible Contaminated Waste related Impact on the Environment & Environmental Protection Measures

3.1 Site Inspection & Sampling

Ash generated from the incineration could be contaminated waste. A visual inspection of the incinerator has therefore been carried out and revealed that there is a small quantity (0.27m³ in total) of incinerator ash left in the combustion furnace and the flue. Sampling of the ash inside the combustion furnace and the horizontal section of the incinerator flue pipe was carried out in late 2002. A total of three samples were collected from the ash residue in the incineration furnace. As the dimension of the incinerator chamber is only

1mx1m, three samples are sufficiently representative of the quality of the residual ash. Two samples of ash residuals in the flue were taken from the horizontal section through two openings. The two samples were taken at the middle and at the far end from the incinerator furnace to provide a good spatial coverage. The number of samples taken from the incinerator and its flue is considered sufficient, as the ash is very limited in quantity (0.27m³ in total). Figure 3-1 shows the sampling locations. All samples were tested by a HOKLAS accredited laboratory. The analytical methods adopted for the tests are:

Determinand	Analytical method
PCB	USEPA No. 680
PAH	USEPA No. 8270
Dioxin	USEPA No. 8290
Heavy metals	USEPA No. 6020

Detailed test reports issued by the laboratory are contained in Appendix B. The parameters tested and their results are tabulated below:

Ash residue inside the furnace

Parameters for analysis*	Assessment Criteria **	Sampling Result		Compliance
		Average	Range	
PCB	1	N. A.	<0.1	Yes
Dioxin	1 ppb	0.011478 ppb	0.007287 – 0.016453 ppb	Yes
PAH				
Naphthalene	5	25.7	16.3 – 39.7	No
Other PAH	5	Below Assessment Criteria	Below Assessment Criteria	Yes
Heavy metals				
Chromium	250	31.0	24.9 – 35.9	Yes
Cobalt	50	4.00	2.37 – 5.37	Yes
Nickel	100	35.0	28.8 – 39.7	Yes
Copper	100	639	75 – 1630	No
Zinc	500	251	134 – 409	Yes
Arsenic	30	2.9	2.1 – 3.4	Yes
Molybdenum	40	13.6	4.97 – 18.7	Yes
Cadmium	5	0.32	0.14 – 0.50	Yes
Tin	50	3.11	2.57 – 3.63	Yes
Barium	400	258	217 – 283	Yes
Mercury	2	0.6	0.46 – 0.70	Yes
Lead	150	16.7	14.1 – 19.3	Yes
* All values are in the unit of mg/kg dry wt. unless otherwise stated.				
** 1. The assessment criteria are referenced to Dutch B standard for land contamination except for dioxin.				
** 2. The assessment criterion for dioxin is referenced to the USEPA standard of 1 ppb (equivalent to 1000 pg/g)				

Sampling from the ash deposits of the captioned incinerator had revealed the following results:

- The dioxin levels in the ash deposits inside the incinerator were below the 1ppb requirement as stipulated by USEPA for residential developments by 20 folds and therefore it is not an issue.
- Other contaminants were compared with the Dutch standard for land contamination as referenced to the precedent case at Pok Oi Hospital.
- Within the metal group, only Copper had exceeded the Dutch B requirement.
- Within the Polynuclear Aromatics group, only Naphthalene has exceeded the Dutch B requirement.
- PCB levels were within the Dutch B requirements.

Therefore, the contaminants found at the captioned furnace are Copper and Naphthalene only.

Ash Residue inside the horizontal flue section

Parameters for analysis	Assessment Criteria	Sampling Result		Compliance
		Sample 1	Sample 2	
Dioxin	1 ppb	12.64 ppb	6.84 ppb	No

- The assessment criterion for dioxin is referenced to the USEPA standard of 1 ppb (equivalent to 1000 pg/g)

There is very limited ash (~0.12m³) left inside the horizontal flue section. The ash samples collected were not enough for performing the complete set of analyses. In view of its relative toxicity, Dioxin has been chosen as the only parameter for analysis in this case. The dioxin levels of the samples were found to be in the order of 10ppb and therefore exceeded the 1ppb requirement as stipulated by USEPA for residential developments.

The incinerator and its flue are therefore considered contaminated and hence the decommissioning of the structures shall therefore be carried out with special care and protection to ensure that any incineration residues that may contain the contaminants Dioxin, Copper and Naphthalene as revealed through sampling are handled, transported and disposed of properly.

3.2 Decommissioning Method – Containment Approach

Decommissioning of the incinerator shall be conducted under containment as a prudent approach to avoid the release of any incinerator ash to the environment, which could be generated during the decommissioning of the incinerator.

3.2.1 Site Preparation and Containment Construction

Preliminary site decontamination of all debris shall be carried out using HEPA vacuum cleaner. Except the incinerator, all other existing items shall be removed from the incinerator room as far as practicable to avoid obstructing the subsequent work activities. The walls, floor and ceiling of the incinerator room, boiler room, and M/E room where the vertical chimney duct is shall be lined with 3 layers of fire retardant polythene sheets.

The top portion of the chimney above the roof shall be enclosed by a chamber with three layers of polythene sheets. At the entrance to each level, a 3-chamber decontamination unit shall be constructed for entry and exit from the work area. The 3-chamber decontamination unit shall comprise a dirty room, a shower room and a clean room of at least 1m x 1m base each with 3 layers of fire retardant polythene sheet where all workers shall carry out decontamination procedures before leaving the work area. A schematic diagram of the decontamination unit and its section view for typical floors are presented in Figure 3-2 and Figure 3-3 respectively. Warning signs in both Chinese and English should be put up in conspicuous areas.

An air mover shall be provided at the incinerator room, boiler room, and at the bottom of the stack to exhaust air from the work area. A stand-by air mover shall also be installed with each of the air movers. Sufficient air movement shall be maintained to give a minimum of 6 air changes per hour to the work area, and maintain a negative pressure of 0.05-0.15 inches of water within the work area throughout the entire course of the decommissioning works. A pressure monitor with printout records and audible alarm shall be installed at an easily accessible location to demonstrate that negative pressure is maintained. New pre-filters and HEPA filters shall be used at the air movers..

A copy of the maintenance records of the air movers should be kept on site for inspection upon request. The appointed contractor shall also check the differential pressure of the air mover to make sure the filter is not blocked. A differential pressure above 0.2 inches of water indicates that the filters would need to be changed. All items remain inside the containment should be covered with at least 2 layers of fire retardant polythene sheets before the decommissioning works should proceed.

3.2.2 Smoke Test

Before commencement of the decommissioning work, a smoke test with non-toxic smoke shall be carried out to ensure the air-tightness of the containment. Also check whether there are stagnant air pockets indicated by an aggregate of smoke that cannot effectively be extracted. After a successful test, switch on the air mover to exhaust smoke from the containment and to give a minimum of 6 air changes per hour, and check visually to see that the absolute filters screen out the smoke effectively and if the pressure gauges read normal. If not, the air mover shall be sealed up and returned to the supplier workshop for necessary servicing, and replaced by a tested air mover. The normal reading pressure range for maintaining 6 air changes per hour shall be 1.5-4 mm/0.05-0.15 inches of water or equivalent (negative pressure). The audible alarm's integrity should also be checked and the trigger shall be at <1.5 mm/0.05 inches of water (negative pressure). Otherwise securely seal up all openings before switching off the air mover.

3.2.3 Treatment and Disposal of Waste

The contractor shall be required to register as a Chemical Waste Producer. All workers shall wear full protective equipment, disposable protective coverall (such as Tyvek) (with hood and shoe covers), nitrile gloves, rubber boots (or boot covers), and full-face positive pressure respirators equipped with a combination cartridge that filters particulate and

removes organic vapour. The organic vapour protection is an added level of protection against the unlikely exposure to any vapour as a necessary measure.

The incinerator flue shall be removed from top down starting from the roof area. The chimney flue shall be taken down in sections by loosening the flanges. Any ash or incineration residues attaching to the incinerator and flue section shall be removed by scabbling and HEPA vacuuming.

The detached sections of the flue shall be wrapped with 2 layers of fire retardant polythene sheets. A third layer shall then be wrapped and secured with duct tape. Decontaminate the outer layer of the wrapped flue sections by wet wiping. The combustion furnace is approximately 1m³, and the entire incinerator is ~2.5 meters tall. Upon removal, the entire incinerator shall be wrapped with 3 layers of fire retardant polythene sheets. The outermost layer shall be secured with duct tape.

Wastes generated from the containment or decontamination unit as described under section 3 of the project profile including the fire retardant polythene sheets, protection clothing of the workers such as the coverall, nitrile glove, rubber boots and materials used for wet wiping shall be disposed of at landfill site.

Wastewater generated from the decontaminated process will be very small and the contractor should take precautionary measures as to minimise the quantity of contaminated water arising. Nevertheless, if any contaminated wastewater needs to be discharged out of the site, it has to be properly treated to WPCO requirements with prior consensus from EPD on discharge standards.

After completion of removal, decontaminate all surfaces, including the wrapped incinerator furnace and flue sections left within the containment, by wet wiping and HEPA vacuum. Then spray the innermost layer of the fire retardant polythene sheet covering the wall, ceiling and floor with PVA. Upon drying, peel off this innermost layer of the polythene sheet covering the containment and dispose of at landfill site.

Repeat the above decontamination procedure for the second innermost layer of fire retardant polythene sheet, including the wrapped incinerator furnace and flue sections left within the containment by wet wiping and HEPA vacuuming. After spraying with PVA, peel off this second innermost layer of the polythene sheet covering the wall, ceiling and floor and dispose of at landfill site. Finally, the last layer of polythene sheet shall then be taken down after spraying with PVA and be disposed as contaminated wastes.

3.2.4 Type of Wastes and Disposal Method

1. Waste to be Disposed to Chemical Waste Treatment Centre

All contaminated ash removed from the incinerator furnace (0.15m³) and chimney flue pipes (0.12m³) as well as the used HEPA filters shall be sent to Chemical Waste Treatment Centre in Tsing Yi. The total volume of such waste was estimated to be 0.5 m³.

2. Waste to be Disposed to Landfill Site

Other wastes including the combustion furnace and its associated panels, the entire flue section, as well as wastes generated from this decommissioning works are also considered as contaminated waste and shall be disposed of at a designated landfill.

Wastes generated from this decommissioning works refer to the polythene wrapping sheets for the incinerator furnace and flue sections, waste generated from the dismantlement of the containment and decontamination units, and cloth used in wet wrapping, etc. as previously described in this section. They shall be placed into appropriate containers such as drums, jerricans, or heavy duty and leak-proof plastic as a prudent approach. The total volume of waste is estimated to be 50 m³. A disposal permit has to be obtained from the Authority. The disposal trip ticket is required to be made available as record after disposal.

4. Other Potential Environmental Impacts

4.1 Land Contamination

The incinerator, with a small furnace capacity of 1m³, was constructed with a durable steel fabrication structure with temperature resistance internal surfacing lining. It was also placed on top of a concrete solid base built on top of a concrete slab which was observed to be in good condition. Furthermore, the incinerator was fuelled by Towngas during its operation and hence there is no separate underground fuel storage associated with the incinerator. Potential land contamination arising from the operation of the incinerator in the past was not identified to be a concern.

4.2 Air Quality

No significant gaseous/dust emission is expected from the decommissioning/demolition of the incinerator as the work shall be carried out in an air-tight condition under negative pressure. With regard to the demolition of the associated structure (i.e. incinerator room), the requirements under the *Air Pollution Control (Construction Dust) Regulation* will be followed.

4.3 Noise

The demolition of incinerator would be carried out by hand-held tools only. The demolition activities are not expected to give rise to any significant noise impact. Demolition activities will be performed in an indoor environment and unlikely be affecting other areas outside the subject premise.

Given the limited quantity of demolition waste associated with the decommissioning of the incinerator, traffic associated environmental impact is not identified to be a key concern.

4.4 Water Quality

Wastewater generated from the decontaminated process will be very small and the contractor should take precautionary measures as to minimise the quantity of contaminated water arising. All wastewater generated within the decontamination unit shall be passed through a filtration system for removal of particles down to 5 micron in suspension before discharge. Nevertheless, if any contaminated wastewater needs to be discharged out of the site, it has to be properly treated to WPCO requirements with prior consensus from EPD on discharge standards.

4.5 Asbestos-Containing Materials

Thorough site inspection was carried out on the entire incinerator and chimney and there was no asbestos-containing materials found in any part of the subject incinerator.

4.6 Unsightly Visual Appearance

The decommissioning/demolition of the incinerator will be carried out inside the existing incinerator room; no particular unsightly visual appearance is envisaged.

5. Conclusion

Given the small size of the incinerator, decommissioning of the facility is not expected to generate any significant environmental impact on the surrounding landuses. The key focus from an environmental perspective is to avoid release of incineration ash to the environment and contamination of the onsite facilities, as well as to implement other standard environmental control measures to control any potential environmental impact such as air and water quality.

6. Use of Previously Approved EIA Reports

This project is found to be similar to a previous project at Pok Oi Hospital in terms of the method of decommissioning and the size of incinerator involved. Therefore the Project Profile completed for the incinerator demolition works at Pok Oi Hospital (ref.: AEP117/2001) will serve as reference for the Tang Shiu Kin Project. The findings of the Profile confirmed that it was not necessary to carry out an EIA for decommissioning the incinerator at Pok Oi Hospital.