

Appendix A : Soil and Groundwater Remediation Criteria

Soil and groundwater criteria used in The Netherlands for contaminated land (“Dutch List”)
(Extracted from Appendix IV of ProPECC PN 3/94)

Soil and ground water criteria used in The Netherlands for contaminated land (“Dutch List”)

Component	Soil (mg/kg dry soil)			Ground water (ug/L)			
	A	B	C	A	B	C	
1. Metals							
Cr	100	250	800	20	50	200	
Cd	20	50	300	20	50	200	
Ni	50	100	500	20	50	200	
Cu	50	100	500	20	50	200	
Zn	200	500	3000	50	200	800	
As	20	30	50	10	30	100	
Mo	10	40	200	5	20	100	
Cd	1	5	20	1	2.5	10	
Sn	20	50	300	10	30	150	
Ba	200	400	2000	50	100	500	
Hg	0.5	2	10	0.2	0.5	2	
Pb	50	150	600	20	50	200	
2. Inorganics							
NH ₄ (as N)	—	—	—	200	1000	3000	
F (total)	200	400	2000	300	1200	4000	
CN	1	10	100	5	30	100	
	(tot.free)	5	50	10	50	200	
	(tot.comb.)	2	20	10	100	300	
S (total)	20	50	300	100	500	2000	
Br (total)	—	—	—	50	200	700	
PO ₄ (as P)	—	—	—	—	—	—	
3. Aromatics Compounds							
Benzene	0.01	0.5	5	0.2	1	5	
Ethylbenzene	0.05	5	50	0.5	20	60	
Toluene	0.05	3	30	0.5	15	50	
Xylenes	0.05	5	50	0.5	20	60	
Phenols	0.02	1	10	0.5	15	50	
Total	0.1	7	70	1	30	100	
4. Polycyclic Hydrocarbons							
Naphthalene	0.1	5	50	0.2	7	30	
Anthracene	0.1	10	100	0.1	2	10	
Fluoranthene	0.1	10	100	0.1	2	10	
Flouranthene	0.1	10	100	0.02	1	5	
Pyrene	0.1	10	100	0.02	1	5	
1,2-benzopyrene	0.05	1	10	0.01	0.2	1	
Total	1	20	200	0.2	10	40	
5. Chlorinated Hydrocarbons							
<u>Aliphatics</u>							
	(Individual)	0.1	5	50	1	10	50
	(Total)	0.1	7	70	1	15	70
<u>Chlorobenzenes</u>							
	(Individual)	0.05	1	10	0.02	0.5	2
	(Total)	0.05	2	20	0.02	1	5
<u>Chlorophenols</u>							
	(Individual)	0.01	0.5	5	0.01	0.3	1.5
	(Total)	0.01	1	10	0.01	0.5	2
Chlor. PAHs (Tot.)		0.05	1	10	0.01	0.2	1
PCB's (Tot.)		0.05	1	10	0.01	0.2	1
EOCL (Tot.)		0.1	8	80	1	15	70
6. Pesticides							
<u>Chlorinated organics</u>							
	(Individual)	0.1	0.5	5	0.5	0.2	1
	(Total)	0.1	1	10	0.1	0.5	2
<u>Pesticides</u>							
	(Total)	0.1	2	20	0.1	1	5
7. Other Pollutants							
Tetrahydrofuran	0.1	4	40	0.5	20	60	
Pyridine	0.1	2	20	0.5	10	30	
Tetrahydrothiophene	0.1	5	50	0.5	20	60	
Cyclohexanes	0.1	6	60	0.5	15	50	
Styrene	0.1	5	50	0.5	20	60	
Gasoline	20	100	800	10	40	150	
Mineral oil	100	1000	5000	20	200	600	

These values are not "standards" but rather guidelines for use in assessing the significance of contaminated land. A simplified explanation of the ABC levels : A-level implies unpolluted, B-level implies pollution present and further investigation required, C-level implies significant pollution present and cleanup (preferably back to the A-level) required.

Remediation Criteria for Dioxin Containing Soil

USEPA criteria of land contamination remediation target for residential sites: 1 ppb TEQ
i.e., 1 ng/g, Toxicity Equivalent Unit

Appendix B Method for Demolition of the Existing Crematorium

The Permit Holder shall follow the method listed in this Appendix and in contaminated materials investigation plan approved under Condition 5.3 to demolish the existing crematorium building and to handle / dispose of the contaminated materials arising.

Classification of contamination	Contaminant level	Demolition Method / Final Disposal
Low / non contaminated materials	Dioxin : <1 ppb TEQ ¹ <u>and</u> Other Pollutants : < Dutch B ²	n/a
Moderate contaminated materials	Dioxin : >1 and <10 ppb TEQ <u>or</u> Other Pollutants : > Dutch B	See Method (I) set out below
Severely (dioxin) contaminated materials	Dioxin : > 10 ppb TEQ <u>and</u> Other Pollutants : any level	See Method (II) set out below

Notes :

1 TEQ –Toxicity Equivalent Unit

2 Soil and groundwater criteria used in The Netherlands for contaminated land (“Dutch List”) - reproduced at Appendix A.

I) Demolition, Handling, Treatment and Disposal of Moderately Contaminated Materials

Before Demolition

- a) The Permit Holder shall cover up the demolition work area to avoid fugitive emission. To achieve this, the Permit Holder shall at least 24 hours before the commencement of demolition:
 - ♦ enclose the top portion of the chimney above the roof by a chamber lined with three layers of polyethene sheets;
 - ♦ construct a 3-chamber decontamination unit at the entrance to the cremators /flues /chimney. The 3-chamber decontamination unit shall comprise a dirty room, a shower room and a clean room, each room of a minimum size of 1m (W) x 1m (L) and be lined with 3 layers of fire retardant polyethene sheet. The shower room shall be fitted with an adequate size tray to collect wash water.
 - ♦ Warning signs in both Chinese and English should be put up at the entrance of the decontamination unit (at the clean end).
- b) The Permit Holder shall provide, to the workers engaged in the demolition of the existing crematorium building, the full protection gear including disposable protective coverall, 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.

During Demolition

- c) The Permit Holder shall ensure the cremators/flue/chimney is removed from top down starting from the chimney.
- d) Before and after removal, the Permit Holder shall scrub and vacuum the cremators/flue/chimney or any other building structures by vacuum cleaner fitted with High Efficiency Particulate Air (HEPA), thoroughly to remove ash or residues attached to them.
- e) All personnel, tools, instrument and sealed wastes should be thoroughly decontaminated in the decontamination unit mentioned in a) above before leaving the work area.

During Treatment / Disposal of Wastes

- f) The Permit Holder shall stabilize the dioxin/heavy metals contaminated materials by mixing with cement prior to disposal at landfill.
- g) The Permit Holder shall obtain prior agreement of the disposal criteria from the Director and agreement to disposal from the landfill operator.
- h) The Permit Holder shall carry out pilot mixing and Toxicity Characteristic Leaching Procedure (TCLP) tests, to the satisfaction of the Director, before the actual stabilization treatment to establish the appropriate ratio of cement to ash waste.
- i) The Permit Holder shall seal the immobilized contaminated ash waste by placing the wastes inside polyethene (either 0.15 mm thickness low-density polyethene or PVC) lined steel drums for disposal at landfill. The drums should be 16 gauge steel or thicker and fitted with double bung fixed ends, sealed and well labelled in new or good condition. The drums should be clearly marked "DANGEROUS CHEMICAL WASTE" in English and Chinese.
- j) As a fall back option, if the landfill disposal criteria cannot be met after immobilization of the ash waste, the Permit Holder shall dispose the ash waste at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.
- k) The Permit Holder shall dispose the following wastes at landfill sites to be designated by the Director:
 - sealed wastes generated from the containment or decontamination unit including the protection clothing of the workers such as the coverall, nitrile glove, rubber boots and materials used for wet wiping; and
 - sealed building structures where contamination is identified.

II) Demolition, Handling, Treatment and Disposal of Severely Contaminated DCM

The Permit Holder shall adopt full containment method and implement the precautionary measures set out below in demolishing the portion of the existing crematorium building where severely contaminated materials are identified.

Before Demolition

- a) The Permit Holder shall, at least 24 hours before the commencement of demolition, complete the following steps:
 - (i) To fully contain the work areas, the following have to be implemented:
 - The walls, floors, ceilings of the cremator rooms shall be lined with 3 layers of polythene sheets;
 - The top portion of the chimney above the roof should be enclosed by a chamber lined with 3 layers of fire retardant polythene sheets
 - (ii) To protect workers involved in decontamination and avoid release of contaminated ash, a 3-chamber decontamination unit shall be constructed at the entrance to the cremators/flue/chimney. The decontamination unit shall comprise a dirty room, a shower room and a clean room, each of a minimum size of 1m (width) x 1m (length) and be lined with 3 layers of polythene sheets. The shower room shall be fitted with an adequate size tray to collect wash water. Warning signs in both Chinese and English should be put up at the entrance of the decontamination unit (at the clean end).

- (iii) To avoid the release of contaminated ash to the environment, air movers, fitted with High Efficiency Particulate Air (HEPA) filters, shall be provided at the cremator room, and at the bottom of the chimney to exhaust air from the work area. A minimum of 6 air changes per hour to the work area, and a negative pressure of 1.5 – 4mm of water within the work area shall be maintained throughout the entire course of the demolition works. A pressure monitor with printout records and audible alarm shall be installed and operated all times during the working period to demonstrate that negative pressure is maintained. The Permit Holder shall replace the filters when a differential pressure above 0.2 inches of water is detected.
- b) To ensure the air-tightness of the containment, the Permit Holder shall, immediately before the execution of demolition, carry out a smoke test in accordance with the following detailed steps:
- i) All rooms and chambers described in a) above shall be filled with non-toxic smoke using a smoke generator. The smoke shall be filled up to a point, with the visibility inside the room reduced to no more than 2m;
 - ii) When the condition described in (i) above is achieved, the smoke generator shall be switched off and a thorough check for smoke leakage outside the rooms and chambers and for stagnant air pockets (indicated by an aggregate of smoke that cannot effectively be extracted) shall be carried out;
 - iii) After the check mentioned in (ii) above, switch on the air mover to exhaust smoke from the containment and to give a minimum of 6 air changes per hour, and visually check whether the filters screen out the smoke effectively and the pressure gauges reading is between 1.5-4 mm of water; and
 - iv) Any leakage of smoke spotted or malfunctioning of air movers, when fulfilling items (ii) and (iii) above, shall be immediately rectified before the commencement of demolition.
- c) The Permit Holder shall provide, to the workers engaged in demolishing the existing crematorium building, full protection gear including disposable protective coverall, 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.

During Demolition

- d) The Permit Holder shall maintain a negative pressure at the containment, described in a(iii) above, ranging from 1.5 to 4 mm of water throughout the entire course of Demolition.
- e) The Permit Holder shall ensure the cremators/flue/chimney is removed from top down starting from the chimney.
- f) Before removal, the Permit Holder shall scrub and vacuum the cremators/flue/chimney or any other building structures by vacuum cleaner fitted with HEPA filters to remove ash or residues attached to them.
- g) The Permit Holder shall require all workers to follow the decontamination procedures as indicated in Figure B, before entering and leaving the rooms and chambers described in item (a) above.
- h) The Permit Holder shall seal the following wastes by 3 layers of polythene sheets and decontaminate the outer layer by wet wiping:
 - (i) all ash and scabbled materials from the cremator, flue pipe and chimney;

- (ii) all detached sections of the cremator, flue pipe and chimney;
- (iii) all wastes arising from the containment approach, including polythene lining used for containment, protection clothing of workers, and all materials for wet wiping; and
- (iv) all used HEPA filters from air movers and vacuum cleaners.

Disposal of Contaminated Wastes

- i) The Permit Holder shall dispose the following wastes at the Chemical Waste Treatment Centre:
 - (i) all sealed ash wastes with severely contaminated DCM and scabbled materials removed from the cremators, chimney and its flue pipe; and
 - (ii) all sealed HEPA filters from air movers and vacuum cleaners.

- j) The Permit Holder shall dispose the following wastes at landfill sites to be designated by the Director:
 - (i) all sealed detached sections of the cremator, chimney and flue pipe and building structures and its associated panels; and
 - (ii) all sealed wastes arising from the Demolition works, including polyethene wrapping sheets for the building structures, waste generated from the dismantlement of the containment and decontamination units including polythene lining sheets, protection clothing of workers, and materials used for wet wiping. They shall be placed into appropriate containers such as drums, jerricans, or heavy duty and leak-proof plastic.