

10 LAND CONTAMINATION IMPACT

10.1 Introduction

- 10.1.1 This section reviews the potential environmental issues associated with land contamination and assesses its implications for the proposed development. The assessments make reference to the previous approved EIA reports for the Kai Tak Airport North Apron Decommissioning (NAKTA Decommissioning EIA, EIAO Register No. AEIAR-002/1998), the Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development (SEKDCFS EIA, EIAO Register No. AEIAR-044/2001) and Decommissioning of the Former Kai Tak Airport other than the North Apron (KTA Decommissioning EIA, EIAO Register No. AEIAR-114/2007) as well as the Recommended Outline Development Plan (RODP).

10.2 Environmental Legislation, Policies, Plans, Standards and Criteria

- 10.2.1 The “*Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop*” (the Guidance Note) issued by the Environmental Protection Department (EPD) shall be referred to for land contamination assessment.
- 10.2.2 The Practice Note for Professional Persons ProPECC PN3/94 “*Contaminated Land Assessment and Remediation*” issued by the EPD was widely used as the assessment guideline for contaminated sites. The Practice Note makes reference to the criteria developed in the Netherlands (the “Dutch ABC Guidelines”).
- 10.2.3 Starting from 15 August 2007, a new guideline, Risk-based Remediation Goals (RBRGs) stipulated in the “*Guidance Note for Contaminated Land Assessment and Remediation*” (the GN) and “*Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management*”, dated July 2007 (the GM) were promulgated for use. A transition period of 3 months (from 15 August to 14 November 2007) was granted, during which project proponents were free to choose either the Dutch B levels stipulated in the ProPECC PN3/94 or the RBRGs stipulated in the GN and GM are used as the assessment guidelines for their contaminated sites.
- 10.2.4 In the context of this EIA Report, CAPs prepared for 1) Radar Station and ii) ex-Government Flying Service (GFS) building have been defined to follow the ProPECC Note No. 3/94 and adopted the Dutch ABC Guidelines as the assessment guidelines for soil and screening levels for groundwater; while the CAP prepared for Hong Kong Aviation Club (HKAC) area has been defined to follow the GN and GM and adopted the RBRGs as the assessment guidelines for soil and groundwater.
- 10.2.5 Since the Dutch criteria were established based on the assumption that groundwater is used as potable water, it is not so appropriate to be applied directly in Hong Kong where groundwater is not generally for potable use. Hence, the Dutch B levels would be only for screening out the chemicals-of-concern (COCs) for risk assessment and are not for assessing groundwater contamination in Hong Kong.
- 10.2.6 A risk-based assessment would therefore be carried out for groundwater contaminants with the concentration exceeding the Dutch B level to evaluate the risks posed to the sensitive receptors. The risk-based assessment that has been adopted in U.S. Environmental Protection Agency (USEPA) takes into account concentrations of individual contaminants in groundwater, the anticipated most sensitive human receptor and the potential exposure pathways. It should be noted that risk assessment could only be undertaken for those chemicals that have a recognized oral slope factor or oral reference dose.

- 10.2.7 Further consideration of contamination issues is provided in Section 3 (Potential Contaminated Land Issues) of Annex 19 “Guidelines for Assessment of Impact on Sites of Cultural Heritage and Other Impacts” of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

10.3 Assessment Methodology

- 10.3.1 In this Study, land contamination assessment in the NAKTA Decommissioning EIA (EIAO Register No. AEIAR-002/1998 and the Environmental Permit No.: EP-006/1998), SEKDCFS EIA (EIAO Register No. AEIAR-044/2001) were reviewed in accordance with the EIA Study Brief (ESB-152/2006). In addition, the KTA Decommissioning EIA (EIAO Register No. AEIAR-114/2007) was also reviewed to obtain further information applicable to this EIA study. A summary of site investigation findings reviewed in these EIAs and the relevant CAP, Contamination Assessment Report and /or Remediation Action Plan (CAR/RAP) is given in **Table 10.1**.
- 10.3.2 Additional information was also obtained through desktop review to further update the findings. In addition, site reconnaissance was also carried out to identify and confirm the potential contaminative landuses within the Study Area.

10.4 Review of Previous EIA Studies

NAKTA Decommissioning EIA

- 10.4.1 The NAKTA Decommissioning EIA was completed in April 1998 and approved under the EIA Ordinance in September 1998. The reference of the approved report in the EIAO Register is AEIAR-002/1998.
- 10.4.2 The land contamination impact assessment of the NAKTA Decommissioning EIA covered the North Apron of the former Kai Tak Airport (NAKTA) and the vicinity of the NAKTA area. The assessment started with a review of the Kai Tak Airport site history including records of historical leakage from the hydrant fuel system within the airport apron. A range of land uses with potential land contamination impact was also identified.
- 10.4.3 A detailed site investigation within the Kai Tak Airport had been undertaken to ascertain the nature, scale and extent of possible ground contamination resulted from known leaks of aviation fuels. The investigation was carried out in two phases.
- 10.4.4 The Phase 1 of the investigation characterised soil gas conditions in 195 boreholes to assess indirectly the likely subsurface soil contamination levels. The survey established the extent of the aviation fuel contamination and identified some “hotspots” coinciding approximately with the locations of historical leaks of aviation fuel and also with other sources. Elevated levels of methane and anaerobic conditions were found in some areas.
- 10.4.5 The Phase 2 assessment included the installation of 77 groundwater wells and the collection of soil and groundwater samples for chemical analysis. This was to confirm the extent and nature of contamination so as to formulate feasible and site-specific remediation options. Results from Phase 2 of the investigation indicated that remediation is required at some areas within the NAKTA.
- 10.4.6 An Environmental Permit has already been obtained for the area of North Apron. The identified contaminated areas at the NAKTA had been cleaned up during the period from 1998 to 2007 in accordance with the Environmental Permit conditions. The permit holder, Territory Development Department (now Civil Engineering and Development Department), has implemented and completed all necessary works for decommissioning accordingly.

SEKDCFS EIA

- 10.4.7 The SEKDCFS EIA was completed in July 2001 and approved under the EIAO in September 2001. The reference of the approved report in the EIAO Register is AEIAR-044/2001.
- 10.4.8 The SEKDCFS EIA reviewed two relevant studies namely Environmental Impact Assessment for the South East Kowloon Development Feasibility Study (SEKDFS EIA) and the NAKTA Decommissioning EIA, to provide the background information for assessment of land contamination impact of the EIA study. The SEKDCFS EIA have identified some sites within the former Kai Tak Airport, which were mainly fuel storage tanks, which were not included in the NAKTA Decommissioning EIA and suggested that land contamination assessment on these sites would be needed when the sites become accessible. In addition, a preliminary contamination assessment (review of site history) at the ex-Government Flying Service (ex-GFS) building was conducted in the SEKDCFS EIA.
- 10.4.9 The SEKDCFS EIA also reviewed the conditions of the urban areas outside the former Kai Tak Airport at the time of the SEKDCFS EIA Study. As provided in the SEKDCFS EIA report, these urban areas as a whole did not have a major contamination problem but for specific hotspots, which might be of potential land contamination concerns. Potentially contaminative landuses in the urban areas included car repair workshops (clusters found in Ma Tau Wai and Kowloon Bay), various petrol stations, Ma Tau Kok gas works, bus terminals, passenger ferry pier at Kowloon City, Electrical and Mechanical Services Department (EMSD) workshops (Sung Wong Toi Road and Cheung Yip Street) and light industries (clusters found in Kwan Tong and Kowloon Bay).

KTA Decommissioning EIA

- 10.4.10 The KTA Decommissioning EIA was completed in October 2007 and approved under the EIAO in December 2007. The reference of the approved report in the EIAO Register is AEIAR-114/2007.
- 10.4.11 A detailed land contamination assessment was carried out under the KTA Decommissioning EIA to review the potential environmental issues associated with land contamination and to assess the implications of land contamination associated with the former Kai Tak Airport other than the North Apron.
- 10.4.12 Site investigations were conducted at the South Apron area, ex-GFS apron area, runway area and a narrow strip of North Apron during the period from December 2005 to June 2007. A total of 77 boreholes and 18 trial pits were constructed to define the nature, scale and extent of possible ground contamination resulted from past and current landuses on the former Kai Tak Airport other than the North Apron.
- 10.4.13 Site investigations results of the KTA Decommissioning EIA study indicated that some individual areas in the South Apron area were contaminated with metals and/or TPH. A small area in the narrow strip of the North Apron near the Kai Tak Tunnel was contaminated with SVOC (benzo(a)pyrene). In addition, the Ex-GFS apron area was contaminated with metals, TPH and VOCs (ethylbenzene and xylenes). No contamination was found in the runway area.
- 10.4.14 As suggested in the KTA Decommissioning EIA, TPH / VOCs / SVOC contaminated soil should be treated by biopiling while metals contaminated soil should be treated by solidification / stabilization. For soil contaminated with metals and TPH, the contaminated soil should be treated by biopiling first and followed by solidification / stabilization. An environmental permit (Environmental Permit No. EP-285/2008) has been granted by EPD on 8 January 2008 to Civil Engineering and Development Department (CEDD) for the implementation all necessary works for decontamination according to the conditions stipulated in the Environmental Permit.

Table 10.1 Summary of Findings in Relevant EIAs

Relevant EIA	Site Investigation Findings	Date of Approval
NAKTA Decommissioning EIA		
NAKTA Decommissioning EIA	<ul style="list-style-type: none"> 195 boreholes and 77 groundwater wells were installed for soil and groundwater contamination assessment. Land Contamination hotspots were identified. Elevated levels of methane and anaerobic conditions were found in some areas. The identified contaminated areas at the NAKTA had been cleaned up during the period from 1998 to 2007 in accordance with the Environmental Permit conditions. 	September 1998 EIAO Register: AEIAR-002/1998
CAP, CAR/RAP for South East Kowloon Development Infrastructure at North Apron Area of Kai Tak Airport	<ul style="list-style-type: none"> Accessed areas within NAKTA which were not covered in NAKTA decommissioning project due to accessibility issue. 134 boreholes were constructed for the purpose of land contamination assessment. Remediation were found to be necessary at 15 borehole locations with soil samples contaminated with metals, Benzo(a)pyrene and Total Petroleum Hydrocarbons (TPH) exceeding Dutch B/C levels. Findings from groundwater risk assessment indicated that the risk level associated with groundwater during construction was acceptable and no remediation for groundwater would be necessary. Free product, identified at one of the groundwater sampling wells, however, required remediation. Solidification / stabilization and biopiling were recommended as the remediation method for metal contaminated soil and organic contaminated soil respectively whereas free product recovery was recommended for groundwater remediation. 	CAP: June 2003 CAR/RAP: October 2005
Remediation Report for South East Kowloon Development Infrastructure at North Apron Area of Kai Tak Airport	<ul style="list-style-type: none"> The Remediation works were conducted according to the CAR/RAP of <i>South East Kowloon Development Infrastructure at North Apron Area of Kai Tak Airport</i> under Contract No. KL39/03 approved by Environmental Protection Department (EPD), HKSAR, in 2005 Free product found in the groundwater monitoring well was manually skimmed off. For soil remediation, cement solidification/stabilization (CSS) was implemented for heavy metal contaminated soil and biopiling was operated for organic contaminated soil as proposed in the approved CAR/RAP. The remediation works were conducted in the period from December 2005 to March 2007. 	August 2007

Relevant EIA	Site Investigation Findings	Date of Approval
SEKDCFS EIA		
SEKDCFS EIA	<ul style="list-style-type: none"> Reviewed SEKDFS EIA and NAKTA Decommissioning EIA. Identified potential contamination hotspots within former Kai Tak Airport and the vicinity. 	September 2001 EIAO Register: AEIAR-044/2001
KTA Decommissioning EIA		
KTA Decommissioning EIA	<ul style="list-style-type: none"> Reviewed and assessed the implications of land contamination associated with the former Kai Tak Airport other than the North Apron. A total of 77 boreholes and 18 trial pits were constructed to define the nature, scale and extent of possible land contamination resulted from past and current landuses on the former Kai Tak Airport other than the North Apron. 	December 2007 EIAO Register: AEIAR-114/2007
CAP, CAR/RAP for the Decommissioned Fuel Pipeline and Hydrant at South Apron of Former Kai Tak Airport	<ul style="list-style-type: none"> 2 site investigations (SI) have been conducted. For the first SI, a total of 16 boreholes and 20 trial pits were constructed with 70 soil samples and 33 water samples collected and analysed for metal, TPH, benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), chlorinated hydrocarbons and heavy metals. For the further SI, a total of 2 boreholes and 1 trial pit have been set up for soil and groundwater sampling. A total of 7 soil samples and 2 groundwater samples were collected for TPH and/or BTEX analyses. 9 soil samples from the first SI were found with metals and TPH exceeding Dutch B/C levels while no exceedance was found in the further SI. Biopiling was proposed to treat organic contaminated soil while Solidification/ Stabilization treatment was recommended for metal contaminated soil. For soil contaminated with TPH and metals, biopiling would be processed followed by cement solidification/ stabilization. 	CAP: January 2006 CAR/RAP: December 2007
CAP for Runway Area (including the Narrow Strip of North Apron) CAR/RAP for Remaining Area of Former Kai Tak Airport and Proposed Cruise Terminal	<ul style="list-style-type: none"> A total of 39 boreholes were constructed and a total of 107 soil samples and 33 groundwater samples were collected and analysed for a range of metals, BTEX, TPH, PAHs and halogenated and non-halogenated hydrocarbons. 1 soil samples was found with benzo(a)pyrene exceeding the Dutch B level. Biopiling was proposed for the organic contamination found. 	CAP: January 2007 CAR/RAP: December 2007

Relevant EIA	Site Investigation Findings	Date of Approval
Supplementary CAP at South Apron Area of Former Kai Tak Airport, CAP, CAR/RAP for South Apron Area of Former Kai Tak Airport (ex-GFS Apron Area)	<ul style="list-style-type: none"> 20 boreholes were constructed and a total of 65 soil samples and 20 groundwater samples were collected and analysed for a range of metals, BTEX, TPH, PAHs and halogenated and non-halogenated hydrocarbons. 11 soil samples was contaminated with metals, TPH and VOCs (ethylbenzene and xylenes) exceeding Dutch B/C level. Floating free products were observed in 3 groundwater wells. Biopiling was proposed to treat organic contaminated soil while Solidification/ Stabilization treatment was recommended for metal contaminated soil Free products were proposed to be skimmed off from the water surface, drummed properly and stored in a designated storage area for the collection by a licensed chemical waste collector for proper disposal. 	<p>CAP: June 2007</p> <p>CAR/RAP: December 2007</p>

10.5 Identification of Sensitive Receivers

10.5.1 Construction workers are the most likely group to be exposed to any potential contaminated materials during the construction and decommissioning stages. The principle exposure routes for workers include:

- Direct ingestion of contaminated soils through eating or drinking / smoking on site; and
- Dermal contact with contaminated soils.

10.5.2 During the operational phase of the Project, the future users / occupants of the contaminated areas are the sensitive receivers. However, if the contaminated areas are remediated, then there would not be any adverse impacts.

10.6 Potential Contaminative Land Uses

Remaining Areas within the Former Kai Tak Airport

10.6.1 Areas within the former Kai Tak Airport (KTA) had been addressed under a number of previous EIA studies except the areas where the “Hong Kong Aviation Club (HKAC) and an open area for car parking” (HKAC Area), “Electrical and Mechanical Services Department (EMSD) Headquarters excluding the external heavy vehicle repairing workshop” (EMSD Headquarters), Radar Station and Ex-GFS building are situated.

10.6.2 The previous findings, in relation with the potential land contamination impacts envisaged associated with the decommissioning of two remaining areas within the former Kai Tak Airport namely the ex-GFS Building and the Radar Station are detailed in **Section 5** of this EIA report and summarized in the following table.

Table 10.2 Identification of Potential Land Contamination Associated with the Remaining Areas within the Former Kai Tak Airport

Potential Land Contamination Location / Activity	Related Concerns
Hangar of HKAC	Small-scale chemical storage
Underground fuel tank with fuel injection facility in the grassland within HKAC	Disused fuel tanks and fuel injection facility
EMSD Headquarters	Containers storage area (oils/paints storage), diesel fuel storage tanks (daily tanks), electricity generator, transformer room
Dangerous goods (D.G.) store behind the ex-GFS building	Storage of chemical wastes, Category 2 items (oxygen, nitrogen, feron 12, carbon dioxide and acetylene) and Category 5 items (paint and thinner)
Hangar of the ex-GFS building area	Use of chemical during maintenance
Underground storage tank (between the D.G. store and the hangar) of the ex-GFS building area	Storage of Category 5 dangerous goods (diesel) with a capacity of 18,000 litres
Ex-GFS building	Workshops, Ni-cad battery room, lead acid battery room, transformer room, generator room, ground equipment and tractor storage
Underground fuel tank within the Radar Station	Storage of diesel with a capacity of 5,000 litres
Standby generator room of the Radar Station	Storage of waste oil in plastic containers and a electricity generator
Fuel tank room of the Radar Station	Storage of diesel in a daily tank
Transformer room of the Radar Station	Materials such as engine coolants, battery fluid and electrical wiring have been used, stored or generated

- 10.6.3 Potential sources of contamination are tabulated above. In order to define the nature and extent of potential land contamination impacts, site investigations (SI) have been conducted at Radar Station and ex-GFS building according to the approved CAPs (**Appendices 5.1a-b**). The findings of the site investigations at Radar Station and ex-GFS building indicated that some areas of the ex-GFS building were identified with metals or organic contamination while no contamination was found at Radar Station. Results of the groundwater risk assessment also showed that the concentrations of the chemicals-of-concern (COCs) in the groundwater collected at Radar Station and ex-GFS building do not exceed risk-based criteria for remediation. Details of the SI findings at Radar Station and ex-GFS building have been presented in their respective CAR or CAR/RAP in **Appendix 5.2a-b**.

- 10.6.4 Since part of the ex-GFS building and Radar Station were still under operation during the SI, a supplementary land contamination assessment was recommended to be carried out upon the cessation of the operations and prior to the redevelopment. However, as no exceedances in Dutch B level were found among the soil samples collected in the areas surrounding the inaccessible areas in both Radar Station and ex-GFS building, contamination, if any, within those inaccessible areas are considered localized and surmountable and its impacts on the surrounding environment are considered to be minimal.
- 10.6.5 For HKAC Area, the SI works were conducted in accordance with the approved CAP during the period from 27 May 2008 to 4 August 2008 (**Appendix 10.1**). Details of the SI will be delineated in the following sections.
- 10.6.6 For EMSD Headquarters, EMSD as the current occupant, should conduct a land contamination assessment and complete the necessary remediation according to relevant EPD's guidelines prior to handing over the site to the Government for redevelopment in the future.

Areas outside the Former Kai Tak Airport

- 10.6.7 Various potentially contaminative landuses were identified outside the former Kai Tak Airport boundary but within the boundary of the KTD, these potentially contaminative landuses are mainly existing occupants including industrial areas located at (i) eastern and southern part of South Apron around Cheung Yip Street, Kai Hing Road and Wai Yip Street, and (ii) western part of North Apron along To Kwa Wan Road.
- 10.6.8 The SEKDCFS EIA has previously reviewed the conditions of the urban areas outside the former Kai Tak Airport at the time of the SEKDCFS EIA Study. The reviewed findings are provided in **Table 10.3** below and as shown in **Figure 10.3**.

Table 10.3 Summary of Information on Various Contaminative Landuses (Extracted from SEKDCFS EIA)

Potentially Contaminative Uses	Information Obtained from Field Observation and Questionnaires	
	General Information	Possible/Potential Sources of Contamination
Car Repair Workshops	<ul style="list-style-type: none"> Size: typical 400 to 800 sq. ft; Activities: car repair, maintenance, rarely some car washing; Long history clusters found in Ma Tau Wai, others scattered over Kowloon Bay 	<ul style="list-style-type: none"> Waste oils e.g. lubricating oils, transmission fluid and engine coolant; and At present, waste oils collected by licensed chemical waste collector but previously such wastes were drained to nearby sewers or stormwater drains.
Petrol Stations	<ul style="list-style-type: none"> Activities: refuelling, storage of fuel, replacing motor oil and car washing. 	<ul style="list-style-type: none"> Underground fuel storage tank leakage (none recorded); Accidental oil spillage (none recorded); and Waste oils and car washing water contaminating drain (none recorded).

Potentially Contaminative Uses	Information Obtained from Field Observation and Questionnaires	
	General Information	Possible/Potential Sources of Contamination
Ma Tau Kok Gas Works	<ul style="list-style-type: none"> • New site: N. Works size 12,500 sq. meters; • Old site: S. Works demolished in 1993, company operation for 63 years; • Activities: town gas production, naphtha and diesel storage; and • Underground pipelines for fuel and gas transportation. 	<ul style="list-style-type: none"> • Leakage from storage facilities; • Leakage from pipelines; and • For the old site, a land contamination study report was produced in 1993.
Bus Terminals	<ul style="list-style-type: none"> • No refuelling, bus washing or fuel storage at bus terminals. 	<ul style="list-style-type: none"> • Not likely to cause significant land contamination.
Ferry Terminals	<ul style="list-style-type: none"> • Passenger ferry pier at Kowloon City; • Size: 1744 sq. meters with 39 years of operation; and • No refuelling or fuel storage some ferry cleaning. 	<ul style="list-style-type: none"> • Only application of lubricating oil, transmission fluids and paints (no disposal needed).
EMSD Workshop	<ul style="list-style-type: none"> • Activities: government vehicle repairing and maintenance (about 3000 vehicles per month); and • Long history of operation 	<ul style="list-style-type: none"> • A large underground waste oil tank was identified; and • Waste disposal and oil & fuel storage generally follows government environmental requirements at present.
Light Industries	<ul style="list-style-type: none"> • As they are mostly located at multi-storey industrial premises, land contamination is unlikely. 	<ul style="list-style-type: none"> • Contamination may have arisen around the sewerage utilities serving these premises as a result of leakage.

10.6.9 In order to 1) update findings from the SEKDCFS EIA study which are associated with potential contamination implication and 2) obtain a more comprehensive set of information of the historical use of the areas, a comprehensive review of the current land uses, historical aerial photographs and past records of dangerous goods storage and chemical waste releases from potential contaminative sites outside the former Kai Tak Airport boundary but within the boundary of the KTD have been conducted in this EIA study. The findings of the historical land uses together with the related concerns of the potential contamination area are summarized in the following **Table 10.4** and as shown in **Figure 10.3**.

Table 10.4 Summary of Reviewed Information on Potential Contaminative Land Uses

Potentially Contaminative Uses	Location	Historical Land Uses	Possible/Potential Sources of Contamination
To Kwa Wan Motor Vehicle Inspection Centre	Long Yuet Street	<ul style="list-style-type: none"> • 1959: Open Sea • 1973: Storage area. • 1975: Vehicle inspection centre noted, but with a smaller size • 1976: The area occupied by the inspection centre extended. 	<ul style="list-style-type: none"> • Contamination may have arisen from localized oil spillage
EMSD Sung Wong Toi Vehicle Maintenance Workshop	Sung Wong Toi Road	<ul style="list-style-type: none"> • 1967: Workshop constructed with stockpiling at the car park area of the main workshop 	<ul style="list-style-type: none"> • Diesel storage tank of 1000 litres • Battery cell, flammable liquid, oil sludge, acidic/alkaline electrolytes, solvents, mineral/lube oil, refrigerants, paints, heavy metal compounds, paints and scrap metal have been used, stored or generated
Petrol Filling Station	Wang Chin Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1980: Vacant • 1988: Workshop • 2005: Vacant • 2006: Petrol filling station identified 	<ul style="list-style-type: none"> • Fuel storage tank
Petrol Filling Stations	Along Kai Fuk Road	<ul style="list-style-type: none"> • 1959: Open Sea • 1980: Vacant • 1985: Petrol filling stations identified 	<ul style="list-style-type: none"> • Fuel storage tank
EMSD Kowloon Bay Vehicle Maintenance Workshop	Cheung Yip Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1967: Vacant • 1973: Warehouse • 1975: Vacant • 1982: Workshop identified 	<ul style="list-style-type: none"> • Mineral oil, flammable liquid, solvent, paint, oily sludge, acidic electrolyte and heavy metal compound have been used, stored or generated in the workshop.

Potentially Contaminative Uses	Location	Historical Land Uses	Possible/Potential Sources of Contamination
Kerry D.G. Godown (Kowloon Bay)	Cheung Yip Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1967: Vacant • 1976: Cargo Storage • 1985: Godown identified 	<ul style="list-style-type: none"> • Storage of Category 2 (Compressed gas), Category 3 (Corrosive substances), Category 4 (Poisonous substances), Category 5 (Substances giving off inflammable vapour), Category 6 (Substances which become dangerous by interaction with water), Category 7 (Strong supporters of combustion), Category 8 (Readily combustible substances), Category 9 (Substances liable to spontaneous combustion) and Category 10 (Other dangerous substances) items.
LPG Filling Station	Wai Yip Street	<ul style="list-style-type: none"> • 1956: Workshop • 1974: Oil Plant • 1993: Vacant • 2001: LPG Station found 	<ul style="list-style-type: none"> • Fuel storage tank
Cargo Working Area	Cheung Yip Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1967: Vacant • 1988: Barging point 	<ul style="list-style-type: none"> • Contamination may have arisen from leakage of chemicals in cargo
LPG Filling Station	Cheung Yip Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1967: Vacant • 1984: Cement Work • 1986: Storage Area • 2002: LPG Filling Station found 	<ul style="list-style-type: none"> • Fuel storage tank

10.7 Impact Assessment

- 10.7.1 Based on the reviewed findings of the previous EIA studies under the NAKTA Decommissioning EIA, all the contaminated areas identified in the North Apron of the former Kai Tak Airport had been cleaned up already.
- 10.7.2 Under the KTA decommissioning EIA, no contamination was found in the runway area and construction works for any future development in the runway area could proceed without the need of prior decontamination.
- 10.7.3 A small area in the narrow strip of North Apron near Kai Tak Tunnel was found contaminated with SVOC (benzo(a)pyrene) according to the previous assessment completed under Agreement No. KDO 01/2006.

- 10.7.4 Besides, as presented in the KTA Decommissioning EIA Report, discrete locations of contamination with TPH and heavy metals (lead and arsenic) were found in the South Apron of the former Kai Tak Airport. The contamination extent was considered relatively confined and localized. In addition, the ex-GFS apron area was found contaminated with metals (lead and copper), TPH and VOCs (ethylbenzene and xylenes). Remediation would be carried out for the identified contamination areas in accordance with the approved KTA Decommissioning EIA Report.
- 10.7.5 **Figure 10.1** summarizes the identified land contamination areas according to previous land contamination assessment studies.
- 10.7.6 The remaining sites within the former Kai Tak Airport yet to be decommissioned include the ex-GFS building and the Radar Station in the South Apron area, and the Hong Kong Aviation Club area and the EMSD Headquarters in the North Apron area. The decommissioning of airport facilities is classified as a Designated Project under Item 1, Part II, Schedule 2 of the EIAO.
- 10.7.7 In order to define the nature and extent of potential land contamination impacts associated with the remaining sites, site investigations have been conducted at Radar Station, ex-GFS building and HKAC Area. The detailed environmental impact assessment on the decommissioning of the ex-GFS building and the Radar Station is presented in **Section 5** of this EIA Report whereas the findings of the site investigations at HKAC Area and the land contamination appraisal of EMSD Headquarters are summarized in the following sections.

Land Contamination Assessment

HKAC Area

- 10.7.8 For HKAC Area, the SI works were conducted at the Hong Kong Aviation Club and its adjacent car park from 27 May 2008 to 4 August 2008 according to the approved CAP (**Appendix 10.1**).
- 10.7.9 A total of 9 boreholes were constructed. Groundwater sampling was conducted at all sampling locations. The as-built locations of sampling boreholes are shown in **Figure 10.2**. A total of 32 soil samples and 9 groundwater samples were collected and analyzed for TPH, SVOCs, VOCs and/or metals. The CAP for HKAC Area was approved by EPD on 28 January 2008 and hence RBRG levels were referred for the assessment.
- 10.7.10 Since the future land uses of the HKAC Area were mainly as institution and community facilities and regional open space in the future and the corresponding RBRGs land use would be Urban Residential and Public Parks respectively. As a conservative approach, the more stringent set of RBRG levels (i.e. Urban Residential) was taken as the assessment criteria.

On-site measurements Photo-ionisation Detector (PID) was undertaken during the SI. In general, the VOC levels of soil samples are low (i.e. below 20ppm), which would not pose harmful effects to site workers during excavation. Slightly elevated PID readings were only recorded at 2 soil samples at AC-10 (1.85-2.3m BBC and 3.35-3.8m BBC with readings at 24.2ppm and 23.6ppm respectively). Petroleum / kerosene smell was not noted during soil sampling at these boreholes.

Laboratory Results

- 10.7.11 Laboratory analytical results of the 32 soil samples and 9 groundwater samples collected during SI revealed no contamination at HKAC Area to the Urban Residential RBRG levels and the saturation limits (C_{sat}) / solubility limits. In addition, as no petroleum or solvent odours were found in soil and groundwater samples during site investigation, the potential occurrence of NAPL was considered to be minimal. Remediation for both soil and groundwater is thus considered to be not necessary. Details of the laboratory analytical results are summarized in the CAR provided in **Appendix 10.2**.

EMSD Headquarters

- 10.7.12 For EMSD Headquarters, a comprehensive review on the current and historical landuses and past records of dangerous goods storage and chemical waste releases has been conducted to identify the potential sources of contamination in relation to the landuses. The review found that the past and current landuses of the site include dangerous goods storages, waste oil storage tanks, chemical waste storage, etc. The findings of the historical landuses together with the related concerns of the potential contamination area are summarized in following **Table 10.5**.

Table 10.5 Summary of Reviewed Information on Potential Contaminative Land Uses

Potentially Contaminative Uses	Location	Historical Land Uses	Possible/Potential Sources of Contamination
EMSD Headquarters	Kai Shing Street	<ul style="list-style-type: none"> • 1959 Open Sea • 1974: Vacant • 1990: Hong Kong Air Cargo Terminal Limited (HACTL) 2 building first identified • 2003: Reconstruction of HACTL2 building • 2005: Hang over of HACTL2 building to EMSD 	<ul style="list-style-type: none"> • For HACTL: hydraulic oil, lubricating oil and various types of chemical waste from uncollected air cargo. • For EMSD (excluding vehicle workshop): Petroleum storage, lubricating oil, cleansing solvent, Engine coolant, battery fluid, anti-corrosive paints, thinner ammonia alkaline solution, spent mercury lamps,

- 10.7.13 The site of EMSD Headquarters is currently occupied by EMSD for the operation as headquarter. This use will continue for the near future and no decommissioning programme is anticipated at the moment. In view of the past and present potential contaminative uses of the EMSD Headquarters, EMSD as the current occupant shall conduct a land contamination assessment and complete the necessary remediation prior to handing over the site to the Government for redevelopment according to relevant EPD's guidelines.
- 10.7.14 Considering land contamination implications are to be anticipated associated with the decommissioning of the 4 sites, the overall land contamination impact would not be significant.
- 10.7.15 With regards to the areas outside the former Kai Tak Airport boundary but within the boundary of the KTD, findings from previous studies and the comprehensive review of current and historical land uses conducted in this EIA study indicated that the urban area as a whole did not have a major contamination problem but for specific hotspots, which might be of potential land contamination concerns.

10.8 Mitigation Measures

- 10.8.1 For the remediation to be conducted for the land contamination areas identified in the KTA Decommissioning EIA, the mitigation measures recommended in the KTA Decommissioning EIA Report as well as those stipulated in the corresponding Environmental Permit should be implemented to control and minimize the associated environmental impacts.
- 10.8.2 For the decommissioning of the ex-GFS building and the Radar Station in the South Apron area, the recommended mitigation measures are detailed in **Section 5** of this EIA Report.

- 10.8.3 For the areas outside the former Kai Tak Airport boundary but within the boundary of the KTD, findings from previous studies and the comprehensive review of current and historical land uses conducted in this EIA study indicated that the urban area as a whole did not have a major contamination problem but for specific hotspots. As precautionary measure to minimize any potential environmental impacts associated with these potential land contaminations, it is recommended that the current occupant(s) or future developer(s) of those identified hotspots should carry out detailed land contamination investigations prior to any redevelopment. If land contamination is confirmed, proper remedial measures should be formulated and implemented prior to the redevelopment of the respective site.

10.9 Evaluation of Residual Environmental Impacts

- 10.9.1 No adverse residual environmental impact would be envisaged, with the implementation of appropriate mitigation measures and remediation action for the contaminated areas.

10.10 Environmental Monitoring and Audit Requirements

- 10.10.1 Details of the environmental monitoring and audit requirements, if required, are provided in the separate EM&A Manual prepared as part of this EIA study for the Kai Tak Development.

10.11 Conclusion

- 10.11.1 The potential environmental issues associated with land contamination together with its implication to the proposed KTD are reviewed and assessed in this section.
- 10.11.2 The assessments of land contamination for the former Kai Tak Airport have been completed in the relevant approved EIAs except for the Radar Station, Ex-GFS building, EMSD Headquarters and the HKAC Area.
- 10.11.3 Based on the reviewed findings from the previous EIA studies and additional information from desktop studies and site inspections, potential contaminative landuses associated with these sites are generally (1) hangar area, (2) fuel storage and injection facilities, (3) dangerous goods and waste chemical storage, (4) generator, transformer and battery rooms and (5) plant and equipment storage.
- 10.11.4 Site investigation has been carried out at Radar Station, the ex-GFS building and HKAC Area. Some areas of the ex-GFS building were identified with metals or organic contamination while no contamination was found at Radar Station and HKAC Area. Results of the groundwater risk assessment indicate that the concentrations of the COCs in the groundwater collected at the Radar Station and the ex-GFS building do not exceed risk-based criteria for remediation. For the groundwater samples collected at HKAC Area, no exceedance of the relevant RBRG levels and the solubility limits were found and hence remediation for groundwater at HKAC Area is considered to be unnecessary as well. The volumes of soil contaminated by different types of contaminants at the ex-GFS building are estimated to be (i) 316.8 m³ of heavy metal contaminated soils and (ii) 72 m³ of TPH/SVOCs contamination soils.
- 10.11.5 As discussed in **Section 5** of this EIA report, biopiling is proposed to treat TPH /SVOCs contaminated soil. Biopile cleanup progress monitoring and closure assessment are proposed for biopiling to ensure a satisfactory cleanup progress and that all the target contaminants have been treated to below the cleanup targets. Solidification / stabilization is suggested to treat the soil contaminated with metals. Toxicity Characteristics Leaching Procedure (TCLP) Test is proposed to be undertaken after solidification / stabilization in order to ensure that the metal contaminants would not leach to the environment.

- 10.11.6 For EMSD Headquarters, EMSD as the current occupant, should conduct a land contamination assessment according to EPD's GN, GM and Guidance Note. If contamination is identified in the EMSD headquarters, remediation of this site shall then be conducted following the CAR/RAP of the respective sites upon EPD's approval and prior to handing over the site to the Government for redevelopment
- 10.11.7 Based on the reviewed findings from the previous EIA studies and additional information from the comprehensive review conducted in this EIA study, potential contaminative landuses outside the KTA are generally (1) vehicle repairing workshops / inspection centre, (2) gas works, (3) bus and ferry terminals, (4) petrol stations / LPG filling stations, (5) EMSD vehicle maintenance workshops (6) light industries and (7) dangerous goods godown (8) cargo working area.
- 10.11.8 In summary, land contamination identified in the North Apron had been cleanup already; previous EIA studies found no land contamination in the Runway area; land contamination identified in the narrow strip of North Apron near Kai Tak Tunnel, South Apron and the Ex-GFS apron area were found relatively confined and localized. Soils with elevated concentration of SVOC, VOCs, TPH and heavy metals would be remediated according to the EPD approved CAR/RAPs. Besides, urban area surrounding the KTD area was found not having any major contamination problem but for specific hotspots, which might be of potential contamination concerns.
- 10.11.9 For the decommissioning of the ex-GFS building and the Radar Station in the South Apron area, the recommended mitigation measures are detailed in **Section 5** of this EIA Report.
- 10.11.10 No adverse residual environmental impact would be envisaged, with the implementation of appropriate mitigation measures and remediation action for the contaminated areas.