

## 4 Air Quality Impact

### 4.1 Introduction

This *Section* presents an assessment of the potential air quality impact arising from the construction and operation of the desalination plant at Tseung Kwan O (TKO) Area 137. Dust is the key potential concern during the construction phase. In operational phase, potential concern is related to air and odour emissions from desalination process. Representative air sensitive receivers (ASRs) have been identified with control measures recommended to minimise the potential impacts.

### 4.2 Statutory Requirements and Evaluation Criteria

The principal legislation for the management of air quality in Hong Kong is the *Air Pollution Control Ordinance (APCO)* (Cap 311). The APCO Amendment was passed in July 2013 and a set of new Air Quality Objectives (AQOs) has been effective from 1 January 2014. The new AQOs stipulate statutory ambient limits for air pollutants and the maximum allowable number of exceedances over specific averaging periods. The new AQOs are presented in **Table 4.1** and they were used as the evaluation criteria for this assessment. As stipulated in *Annex 4* of the *Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*, the AQOs and other relevant standards established under the *APCO* should be met.

**Table 4.1 Hong Kong Air Quality Objectives ( $\mu\text{g m}^{-3}$ )<sup>(a)</sup>**

Air Pollutant	Averaging Time	Concentration ( $\mu\text{g m}^{-3}$ ) <sup>(a)</sup>	No. of Exceedances Allowed per Year
Sulphur Dioxide (SO <sub>2</sub> )	10 minute	500	3
	24-hours	125	3
Respirable Suspended Particulates (RSP) <sup>(b)</sup>	24-hours	100	9
	Annual	50	-
Fine Suspended Particulates (FSP) <sup>(c)</sup>	24-hours	75	9
	Annual	35	-
Nitrogen Dioxide (NO <sub>2</sub> )	1-hour	200	18
	Annual	40	-
Ozone (O <sub>3</sub> )	8-hours	160	9
Carbon Monoxide (CO)	1-hour	30,000	-
	8-hours	10,000	-
Lead	Annual	0.5	-

**Notes:**

(a) Measured at 293K and 101.325 kPa.

(b) Suspended particles in air with a nominal aerodynamic diameter of 10  $\mu\text{m}$  or less

(c) Suspended particles in air with a nominal aerodynamic diameter of 2.5  $\mu\text{m}$  or less

A maximum hourly TSP level of 500  $\mu\text{g m}^{-3}$  at ASRs is also stipulated in Annex 4 of the EIAO-TM to assess potential construction dust impacts. The measures stipulated in the Air Pollution Control (Construction Dust) Regulation should also be followed to ensure that any dust impacts are minimised.

Annex 4 of the EIAO-TM also stipulates that any predictive assessment of the odour impact should meet 5 odour units based on an averaging time of 5 seconds.

### 4.3 Baseline Condition

The proposed site for the desalination plant is located in the southeast of TKO Area 137 with a reserved site area of about 10 hectares. TKO Area 137 is located to the south of the Southeast New Territories (SENT) Landfill and the Tseung Kwan O Industrial Estate. TKO Area 137 Fill Bank is located to the west of the proposed plant while SENT Landfill, the proposed SENT Landfill Extension and the TKO Industrial Estate are located to the north of the proposed plant. Furthermore, as part of the Project, there is a proposed fresh water main along Wan Po Road and Po Hong Road, connecting the proposed desalination plant with the existing Tseung Kwan O Fresh Water Primary Service Reservoir (TKOFWPSR). Therefore, the local air quality is influenced mainly by dust emissions from TKO Area 137 Fill Bank and SENT Landfill, vehicle emissions from nearby roads (i.e. Wan Po Road), and industrial emissions from the Tseung Kwan O Industrial Estate.

The nearest EPD's Air Quality Monitoring Station (AQMS) is located in Kwun Tong. The latest 5 years annual averaged concentrations (2009 - 2013) of RSP, FSP, NO<sub>2</sub> and SO<sub>2</sub> recorded at this AQMS are presented in **Table 4.2**.

**Table 4.2 Baseline Air Quality** <sup>(a)</sup>

Air Pollutant	Annual Averaged Concentration ( $\mu\text{g m}^{-3}$ ) in the Recent 5 Years						Annual AQOs
	2013	2012	2011	2010	2009	5-year average	
SO <sub>2</sub>	12	11	12	10	11	11	- <sup>(b)</sup>
NO <sub>2</sub>	59	59	63	59	58	60	40
RSP	52	43	49	47	48	48	50
FSP <sup>(c)</sup>	33	28	--	--	--	31 <sup>(d)</sup>	35

**Notes:**

- (a) 5 years annual average concentrations (2009 - 2013) of air pollutants measured at EPD's AQMS in Kwun Tong.  
(<http://www.aqi.gov.hk/en/download/air-quality-reportse469.html?showall=&start=1>)
- (b) No annual AQO for SO<sub>2</sub> Concentration.
- (c) FSP monitoring data at the EPD Kwun Tong AQMS are publicly available since 2012.
- (d) It is the average of two year averaged values.

The aforementioned monitoring results are indicative of the prevailing baseline air quality at the Site. The 5-year averages of RSP and FSP concentrations in 2009 - 2013 are below their respective AQOs (ie  $50\mu\text{g m}^{-3}$  and  $35\mu\text{g m}^{-3}$ , respectively), while the 5-year average of  $\text{NO}_2$  concentration ( $60\mu\text{g m}^{-3}$ ) has exceeded the AQO (i.e.  $40\mu\text{g m}^{-3}$ ).

#### 4.4 Study Area and Identification of air Sensitive Receivers

In accordance with the *EIA Study Brief Section 3.4.2.2* of the Project, the Study Area for the air quality impact assessment is generally defined by a distance of 500m from the boundary of the Project Site. Air Sensitive Receivers (ASRs) were identified within the Study Area in accordance with *Annex 12 of EIAO-TM*. Latest Outline Zoning Plans (OZP), Outline Development Plan (ODP) and relevant land use plans published by Lands Department were also reviewed to identify future or committed ASRs. Representative ASRs have been identified within the Study Area during construction and operation phases of the Project and are summarised in **Table 4.3**. The Study Area and the identified representative ASRs are shown in **Figure 4.1**.

**Table 4.3 Identified Representative Air Sensitive Receivers**

ASR	Description	Type of Use	Approximate Maximum Height (m above ground)	Approximate Separation Distance from the Nearest Pipe Works (m)	Approximate Separation Distance from the Nearest Plant Works (m)	Construction Phase	Operational Phase
A1	Offices at SENT Landfill Extension	Office	5	45	200	✓	✓
A2	Offices at Existing SENT Landfill	Office	5	90	680	✓	
A3	TVB City	Commercial	50	45	1000	✓	
A4	Apple Daily	Industrial	20	35	1450	✓	
A5	Next Media Ltd.	Office	15	25	1700	✓	
A6	LOHAS Park – La Splendur	Residential	180	100	2750	✓	
A7	The Beaumont	Residential	114	175	3000	✓	
A8	Shaw Tseung Kwan O Film Studios	Industrial	20	80	3300	✓	
A9	Creative Secondary School	Educational	24	35	4250	✓	
A10	Oscar By the Sea	Residential	175	85	4320	✓	
A11	Tseung Kwan O Plaza Tower 1	Residential	135	20	4600	✓	
A12	Beverly Garden	Residential	120	45	4730	✓	
A13	Kwong Ming Court	Residential	110	45	5000	✓	
A14	Haven of Hope Hospital	Hospital	18	100	5480	✓	
A15	Po Hong Park	Recreational	0	60	5800	✓	
A16	Verbena Heights	Residential	169	45	6060	✓	
A17	Serenity Garden	Residential	9	25	6320	✓	
A18	Tseung Kwan O Village	Residential	9	25	6780	✓	
A19	King Ming Court	Residential	105	20	6600	✓	
A20	School of Continuing and Professional Studies of the Chinese University of Hong Kong	Educational	24	20	6500	✓	

## **4.5 Potential Sources of Impacts**

### **4.5.1 Construction Phase**

The construction of the proposed desalination plant, fresh water main and other associated works has the potential to cause dust nuisance if not properly managed. Dust in terms of Total suspended particulates (TSP), respirable suspended particulates (RSP) and fine suspended particulates (FSP) are the key air pollutants during construction.

The key construction activities for the Project are listed below:

- Construction of the desalination plant – foundation and piling, building works, submarine intake and outfall, installation of electrical and mechanical plant and equipment, testing and commissioning;
- Natural slope mitigation works – construction of flexible barrier and soil nailing at the toe of the rock slope and stabilisation of natural slopes and boulders on the natural slope within the Clear Water Bay Country Park;
- All the associated civil, structural, geotechnical, landscaping, electrical and mechanical works; and
- Construction of trunk feed system.

The site for the Project has been formed and no major earthworks or site formation works will be required.

Soil excavation, materials handling, truck movements on unpaved roads and wind erosion from open stockpiling of dusty materials within the Project Site are identified to be the potential dust generating activities.

Tentatively, the construction of the Project will last for about 54 months and is scheduled to commence in 2<sup>nd</sup> quarter of 2016. The normal working hours will be between 07:00 and 19:00 hrs from Monday to Saturday (except public holidays).

### **4.5.2 Operation Phase**

No gaseous emission is anticipated during the operation of the desalination plant. However, there is potential gaseous emission from the standby generator and potential odour nuisance may be resulted from the transportation, storage and handling of sludge produced during the desalination process.

## **4.6 Evaluation of Impacts**

### **4.6.1 Construction Phase**

*Construction of the Desalination Plant, Slope Mitigation Works within Clear Water Bay Country Park, Associated Civil Works*

The construction of the desalination plant, including slope mitigation works and other associated works, will take approximately 39 months.

Hoarding will be erected around the site prior to the commencement of the foundation work. Pile foundation with reinforced concrete pile caps will be used for the foundations of the buildings. Reinforced concrete slab and raft foundation will be built for the desalination plant. The majority of excavation materials will be generated during piling works and construction of the basement and concreting works. With reference to the detailed estimation on the quantities of excavated materials generated during construction phase in *Section 8.3.2*, a total of about 183,720 m<sup>3</sup> of excavated materials will be generated from the construction of desalination plant. About 180,117 m<sup>3</sup>, 2,744m<sup>3</sup> and 859m<sup>3</sup> of the excavated materials will be disposed of at fill bank as public fill, at landfill as construction waste, and as marine sediments, respectively. The nearest ASR – A1 is located about 200 m from the nearest works boundary of the building construction works, therefore, the fugitive dust impact is minor.

Open onshore intake or submerged intake and outfall pipes will also be constructed. The location of the worksite is more than 700 m from the nearest ASR – A1, therefore, the fugitive dust impact from the works are minor.

Construction of flexible barriers and soil nailing at the toe of the natural slope within the Clear Water Bay Country Park for slope mitigation works and other associated civil works will also be carried out. These works will involve very minor excavation works which are expected to result in 56 m<sup>3</sup> of excavated materials. About 55 m<sup>3</sup> and 1 m<sup>3</sup> of the excavated materials will be disposed of at fill bank as public fill and at landfill as construction waste, respectively. The nearest worksite is about 250 m from the nearest ASR – A1, therefore, very limited fugitive dust emission is anticipated.

With the implementation of dust control measures stipulated under the *Air Pollution Control (Construction Dust) Regulation* and those recommended in *Section 4.8.1*, together with proper site management and good housekeeping, no adverse fugitive dust emission is expected from the construction works.

A concrete batching plant (CBP) with production rate of about 30 m<sup>3</sup> per hour is proposed to be erected on site for concreting works of the desalination plant construction. As indicated in *Figure 4.1*, the proposed on-site concrete batching plant will be located more than 500m away from the nearest existing ASR (i.e. A1) and hence the impact arising from the operation of the CBP would be minimal. Should the total silo installed capacity of the CBP exceeds 50 tonnes, a licence under *Air Pollution Control (Specified Process) Regulation* is required.

### *Construction of the Trunk Feed System*

The trunk feed system includes the construction of a 9 km long and 1,200 mm in diameter fresh water main for the transfer of fresh water output from the desalination plant to the existing TKOFWPSR. The laying of the entire fresh water mains will be divided into 3 sections, Section A from desalination plant to Shek Kok Road, Section B from Shek Kok Road to Po Shum Road, and Section C from Po Shun Road to TKOFWPSR. The system also consists of a new pumping station, a new treated water storage tank and the associated pipeworks and ancillary facilities including fittings/valves, leakage, flow and pressure monitoring facilities in the proposed desalination plant. The construction of the trunk feed system will be carried out for about 45 months. The fresh water main will be constructed in small sections using open cut method and trenchless method using pipe jacking. The open cut method involves soil excavation works and backfilling, which may have the potential to cause fugitive dust emissions, and negligible dust emissions are expected from the trenchless method. As the fresh water main will be constructed in small sections (ie, 40 m), the excavated materials generated will be limited (42,733 m<sup>3</sup>) and limited number of construction plant will be deployed for the works. With such a small construction site and the implementation of dust control measures recommended in *Section 4.8.1* during works, potential dust emissions from the aforementioned works will be minimal and hence, no adverse dust impact on nearby ASRs is anticipated.

#### 4.6.2 Operation Phase

A typical process of desalination has been described in *Section 3.5*. By reviewing the desalination process, no gaseous emission is anticipated.

It is understood that the sludge produced is primarily chemical in nature and would cause limited odour emissions. The sludge produced in the desalination plant is similar to sludge produced in water treatment works in Water Supplies Department, with very low content in organic sulfate, hence the potential for odour (such as H<sub>2</sub>S) generation from biochemical process is low. Forced ventilation system with sufficient air change rate would be equipped at the sludge treatment and storage building and the exhaust discharge should be directed away from ASRs as far as practicable. In accordance with the *Waste Disposal Ordinance (WDO)*, the chemical sludge produced will be thickened and dewatered to 30% dry solids prior to disposal at the landfill. With the provision of ventilation system with sufficient air change rate and proper handling and disposal of the chemical sludge as discussed in *Section 4.8.2*, no adverse odour nuisance to nearby ASRs is envisaged. In addition, there is considerable separation distance between the nearest ASR (i.e. A1) and the sludge building, which is about 250m. Hence, no adverse odour impact is anticipated.

A standby generator will be provided and located at the southeast corner of the proposed plant. As the standby generator will only operate when CLP's grid is suspended, the operating time of the generator is very rare and adverse air quality impact caused by gaseous emissions from the generator is not expected.

## **4.7 Cumulative Impacts**

### **4.7.1 Construction Phase**

As mentioned in *Section 3.8*, potential concurrent projects during the construction phase of the Project include Cross Bay Link (CBL), Tseung Kwan O – Lam Tin Tunnel and Associated Works (TKO – LTT), Trunk Road T2, South East New Territories (SENT) Landfill Extension and Fill Bank at TKO Area 137. TKO – LTT and Trunk Road T2 are all more than 1.5 km and 4 km away from the nearest construction site boundary and any cumulative impact from these projects is considered negligible. CBL, SENT Landfill Extension and Fill Bank at TKO Area 137 are located within 500 m of the Project Site during construction. As discussed in *Section 4.6.1*, the construction work of this Project is minor and dust mitigation measures and good site practices will be adopted, therefore, it is anticipated that no adverse cumulative dust impact is expected.

### **4.7.2 Operation Phase**

Since CBL, TKO – LTT and Trunk Road T2 are located more than 3 km away from the Project Site in operation phase, the cumulative impact is not anticipated. It is understood that the existing Fill Bank at TKO Area 137 will cease to operate after 2018. With the anticipated operation year of the desalination plant after 2020, there will be no cumulative impact from Fill Bank at TKO Area 137. The SENT Landfill Extension is located within 500m of the Project Site. As discussed in *Section 4.6.2*, the chemical sludge produced in the desalination plant will cause very limited odour emissions, if any. Therefore, no adverse cumulative odour impact is anticipated during the operation phase of the Project.

## **4.8 Mitigation Measures**

### **4.8.1 Construction Phase**

The following dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulations* and good site practices will be incorporated into the Contract Specifications and implemented throughout the construction period:

- Impervious dust screen or sheeting will be provided to enclose scaffolding from the ground floor level of building for construction of superstructure of the new buildings;
- Impervious sheet will be provided for skip hoist for material transport;
- The area where dusty work takes place should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after dusty activities as far as practicable;
- All dusty materials should be sprayed with water or a dust suppression chemical immediately prior to any loading, unloading or transfer operation;
- Dropping heights for excavated materials should be controlled to a practical height to minimise the fugitive dust arising from unloading;



- During transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;
- Wheel washing device should be provided at the exits of the work sites. Immediately before leaving a construction site, every vehicle shall be washed to remove any dusty material from its body and wheels as far as practicable;
- Road sections between vehicle-wash areas and vehicular entrance will be paved;
- Hoarding of not less than 2.4m high from ground level will be provided along the length of the Project Site boundary;
- Haul roads will be kept clear of dusty materials and will be sprayed with water so as to maintain the entire road surface wet at all times;
- Temporary stockpiles of dusty materials will be either covered entirely by impervious sheets or sprayed with water to maintain the entire surface wet all the time;
- Stockpiles of more than 20 bags of cement, dry pulverised fuel ash and dusty construction materials will be covered entirely by impervious sheeting sheltered on top and 3-sides;
- All exposed areas will be kept wet always to minimise dust emission;
- Ultra-low-sulphur diesel (ULSD) will be used for all construction plant on-site, as defined as diesel fuel containing not more than 0.005% sulphur by weight) as stipulated in *Environment, Transport and Works Bureau Technical Circular (ETWB-TC(W)) No 19/2005* on Environmental Management on Construction Sites;
- The engine of the construction equipment during idling will be switched off;
- Concrete batching plant will be required on site. The control measures recommended in the *Guidance Note on a Best Practicable Means for Cement Works (Concrete Batching Plant) (BPM 3/2 (93))* will be implemented; and
- Regular maintenance of construction equipment deployed on-site will be conducted to prevent black smoke emission.

#### 4.8.2 Operation Phase

Odour mitigation measures may be implemented during the operation of the desalination plant. The treatment and storage of the chemical sludge should be enclosed inside building structure. Forced ventilation system with sufficient air change rate would be equipped at the sludge treatment and storage building and the exhaust discharge should be directed away from ASRs as far as practicable.

The chemical sludge produced at the desalination plant should be removed off-site regularly to avoid accumulation of potentially odourous materials on site. Proper handling and transportation of the dewatered sludge to landfill will be conducted to minimise odour nuisance to nearby ASRs. Trucks transporting the dewatered sludge

to the landfill would be fully enclosed to minimise any off-site odour impact during the transportation process.

#### **4.9 Residual Impacts**

No adverse residual impact is anticipated from the construction and operation of the Project with the implementation of the recommended mitigation measures and good construction site practices.

#### **4.10 Environmental Monitoring and Audit**

No adverse fugitive dust impact is anticipated during the construction period, dust monitoring is considered not necessary. However, it is recommended to conduct regular environmental site audit, ie, on weekly basis, to ensure the implementation of the dust control measures and good site practices as recommended in *Section 4.8.1* throughout the construction period.

No adverse air quality or odour impact is anticipated during the operation of the desalination plant, therefore, no air quality or odour monitoring is considered necessary.

#### **4.11 Conclusions**

##### **4.11.1 Construction Phase**

Potential dust generating activities, including excavation and filling, materials handling, truck movements on unpaved roads and wind erosion of temporary stockpile of dusty materials have the potential to cause adverse fugitive dust impacts to the nearby ASRs if not properly managed. As the site has been formed, only minor excavation from the foundation and piling works are required. No fugitive dust emission is anticipated from the building construction and civil works. The worksite of open onshore intake or submerged intake and outfall pipes and also slope stabilization works are located more than 250 m from the nearest ASR, therefore, fugitive dust emission is minor. With the implementation of the recommended dust control measures and adoption of good construction site practices, no adverse fugitive dust impact is anticipated. The fresh water mains will be laid in small sections using open-cut method and small-scale excavation works will be required. Since the excavated materials generated will be relatively small and the worksite is small, no adverse fugitive dust impact is envisaged provided that the recommended dust control measures are properly implemented. No cumulative impact is anticipated during the construction phase of the Project.

To ensure proper implementation of the recommended dust mitigation measures and good construction site practices during the construction phase, environmental site audits on weekly basis is recommended throughout the construction period.

##### **4.11.2 Operation Phase**

By reviewing the process flow, no gaseous emission during operation is anticipated. Potential gaseous emission from the standby generator within the desalination plant is

infrequent and transient. Hence, no adverse air quality impact is anticipated. Sludge produced from the desalination process is chemical sludge and the potential to cause odour nuisance is low. With the implementation of proper odour control measures and good management practices, no adverse odour impact is anticipated during the operation of the desalination plant. As no adverse air quality or odour impact is anticipated during the operation of the desalination plant, therefore, no air quality or odour monitoring is considered necessary.