3 AIR QUALITY

Introduction

3.1 This Section presents an assessment of the potential air quality impacts associated with the construction and operation (under normal operation condition) of the Project. The assessment would focus on the proposed disinfection facilities (chlorination and dechlorination facilities) at SCISTW according to the requirements of Study Brief.

3.2 During the construction phase, fugitive dust emissions arising from materials handling and site excavation would be the main sources of air pollution. Dust impacts associated with the construction works have been assessed and mitigation measures were recommended, where necessary.

3.3 The assessment also identified any potential odour/fugitive emission during construction and operation of the Project on the nearby sensitive receivers including the adjacent Government Dockyard office, the Ngong Shuen Chau Barracks and the planned diving rescue and diving training centre for the Fire Services Department.

Environmental Legislation, Policies, Plans, Standards and Criteria

3.4 The criteria for evaluating air quality impacts and the guidelines for air quality assessment are laid out in Annex 4 and Annex 12 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), respectively.

3.5 The Air Pollution Control Ordinance (APCO) provides the statutory authority for controlling air pollutants from a variety of sources. The Hong Kong Air Quality Objectives (AQOs), which stipulate the maximum allowable concentrations over specific periods for typical pollutants, should be met. The relevant AQOs are listed in **Table 3.1**.

Table 3.1 Hong Kong Air Quality Objectives

Pollutant	Maximum Average Concentration (µg m^{-3}) (1)			
	1-Hour (2)	8-Hour (3)	24-Hour (3)	Annual (4)
Total Suspended Particulates	-	-	260	80
Respirable Suspended Particulates (5)	-	-	180	55
Sulphur Dioxide	800	-	350	80
Nitrogen Dioxide	300	-	150	80
Carbon Monoxide	30,000	10,000	-	-

(1) Measured at 298 K and 101.325 kPa.
(2) Not to be exceeded more than three times per year.
(3) Not to be exceeded more than once per year.
(4) Arithmetic mean.
(5) Suspended particulates in air with a nominal aerodynamic diameter of 10 µm or smaller.

3.6 The EIAO-TM also stipulates that the hourly total suspended particulates (TSP) level at sensitive receivers should not exceed 500 μgm^{-3} (measured at 25°C and one atmosphere) for construction dust impact assessment. Mitigation measures from construction sites have been specified in the Air Pollution Control (Construction Dust) Regulations.

3.7 In accordance with the EIAO-TM, odour at an air sensitive receiver should not exceed 5 odour units based on an averaging time of 5 seconds for odour prediction assessment.

Description of the Environment

Baseline Conditions

3.8 The proposed chlorination/dechlorination disinfection facilities would be constructed within the existing sewage treatment works on Stonecutters Island and adjacent to Container Port Road South

Roundabout. Land uses in the surrounding area of the Project site include the Government dockyard, refuse transfer station, bus depot and container terminal.

3.9 Within the 500 m from the Project site, the nearby existing air pollution emission sources contribute to the ambient air quality of the Assessment Area including:

(a) Vehicle exhaust emissions from local road network including Container Port Road South, Lai Po Road and Ngong Shung Road;

(b) Odour emission from West Kowloon Refuse Transfer Station (WKRTS), the emission sources are:
- exhaust vent pipe from air scrubbing system units of the tipping hall;
- refuse vehicles queuing on the access ramp to Tipping Hall;
- berthing area for containers.

(c) Odour emission from existing SCISTW. The potential odour emission sources includes
- influent channel;
- flocculation tank;
- sedimentation tank;
- exhaust vent pipes of deodorizing units at Main Pumping Station & Dewatering House;
- open chambers; and
- open channel of North West Kowloon Inlet Works.

3.10 The EPD air quality monitoring station at Sham Shui Po is located nearest to the Assessment Area. The latest published air quality monitoring data at this station is in year 2005 and the annual average concentrations of pollutants, the latest reliable data to reflect the existing condition, are summarized in **Table 3.2**.

Table 3.2 EPD Air Quality Monitoring Data at Sham Shui Po Station in 2005

Pollutant	Annual Average Concentration (μg/m^3)
Sulphur Dioxide	24
Nitrogen Dioxide	65
Ozone	25
Total Suspended Particulates	83
Respirable Suspended Particulates	56

Air Sensitive Receivers

3.11 The Assessment Area for air quality impact is defined by a distance of 500 m from the boundary of the Project site (i.e. the work area for chlorination and dechlorination facilities and associated works) as shown in **Figure 3.1**. Within the Assessment Area, representative worst affected Air Sensitive Receivers (ASRs) have been identified in accordance with the criteria stipulated in the EIAO-TM. Domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, home for the aged and active recreational activity areas are classified as ASRs. Details of representative ASRs and their horizontal separation from the site boundary are listed in **Table 3.3**. **Figure 3.1** shows the locations of the ASRs.

Table 3.3 Details of Air Sensitive Receivers

ASR	Description	Uses	Height (storey)	Distance between ASR and nearest works area (m)
AS1	Planned FSD Diving Rescue and Diving Training Centre	GIC	5	208
AS2	Government Dockyard (Offices)	GIC	2	182

ASR	Description	Uses	Height (storey)	Distance between ASR and nearest works area (m)
AS3	Ngong Shuen Chau Barracks – Group 1	GIC	2	442
AS4	Ngong Shuen Chau Barracks – Group 2	GIC	1	162
AS5	COSCO HIT Terminal	Industrial	12	175
AS6	KMB Depot (Office)	Industrial	2	260

Identification of Environmental Impacts

Construction Phase

3.12 The proposed construction work for the Project was described in Section 2. The major activities include construction of a sodium hypochlorite storage tank farm (next to the existing Northwest Kowloon Pumping Station) and a day tank (next to the flow distribution chamber for the chlorination system, a sodium bisulphite storage tank farm (next to Container Port Road South roundabout) for the dechlorination system, and installation of associated dosing facilities and pumping systems.

3.13 Construction works for the Project would involve site formation, excavation, piling, pipe laying, fabrication and erection of storage tanks, and superstructure construction. . The installation of equipment, fabrication and erection of storage tanks, and most of the superstructure construction work would not be dusty activities. The foundation work can be carried out either by percussive piling method or non-percussive piling method. In view of the environmental impacts arising from the piling activities, non-percussive piling method which generated lower noise and dust emissions is recommended to be adopted. To minimize potential dust emission, construction method resulting in minimum exposed surface is preferable for excavation works. Given the need for provision of the pipe trench for the pipe laying works and the relatively shallow excavation depth required, the trenchless excavation method, although could result in the lesser dust emission, is considered not feasible for this Project. Open cut method would generally be adopted. Dust control measures are presented in Section 3.29 to minimize the dust impact.

3.14 Potential construction dust would be generated from construction activities including site formation, excavation and backfilling, materials handling at the construction sites for chlorination plant and dechlorination plant. The two major construction sites for the chlorination plant and dechlorination plant are located within the existing boundary of the SCISTW with size of about 73 m x 24 m and 27 m x 19 m respectively. The other construction work sites are for laying feeding pipes from barge unloading facility to storage tanks and from storage tanks to day tank. The detail locations of these pipelines are indicated in **Figure 2.1**. The estimated total quantity of excavation would be less than 10,000 m^3. The scale of the work is considered small. As the nearest representative ASRs are located at a certain distance (at least 162m) from the work sites, adverse dust impacts arising from these works sites would not be expected during the construction phase.

3.15 The construction site for FSD Diving Rescue and Diving Training Centre will be located within 500 m of the Assessment Area and its construction period would be from November 2006 to February 2009. The construction period for proposed disinfection facilities would be from March 2008 to end 2009. The overlap period for both projects would be about one year. It is expected that the site formation and foundation works for FSD Diving Rescue and Diving Training Centre would be completed in the initial phase of the work programme (within one year). The activities at FSD Diving Rescue and Diving Training Centre would be superstructure work which is a non-dusty activity in the overlap period. Therefore, cumulative construction dust impact would be insignificant.

3.16 The construction activities of HATS Stage 2A Project would commence after the completion of this Project. No cumulative construction dust impacts from HATS Stage 2A project would be expected at the representative ASRs.

3.17 In accordance with the construction programme and preliminary engineering design, no temporary

sewage facilities would be provided and no extra open tank for sewage exposed to the atmosphere. Odour emission arising from the Project during the construction phase would not be expected.

Operational Phase

Chlorination Facilities

3.18 The proposed chlorination facilities contain five sodium hypochlorite storage tanks, chemical feed pumps and chemical unloading facilities. The chlorination facilities are chemical storage area and association dosing system. Sodium hypochlorite solution would be used for chlorination and would be stored in the storage tanks located next to the Northwest Kowloon Pumping Station.

3.19 Sodium hypochlorite solution (w/v 10%-12%) as the disinfection agent would be purchased and would be delivered to SCISTW by a specially designed delivery barge and be unloaded at the berthing facility at an interval of 2 to 3 times a week (If the weather condition is worse or other conditions which do not allow chemicals delivery by barge, sodium hypochlorite solution would be delivered by vehicle). Sodium hypochlorite solution would be transferred to the storage tanks in the chlorination plant through a piping system laid within pipe trench. The chemical would then be pumped from the storage tanks to a day tank (enclosed structure) near the flow distribution chamber. Sodium hypochlorite solution in the day tank will be combined with the carrier water (effluent) and will then be dosed under the effluent surface at the flow distribution chamber for effluent disinfection. With well mixing between the chemical solution and the effluent in the flow distribution chamber, the chemical would react with ammonia in the effluent to form chloramines which has no unpleasant odour or taste. The locations of the storage facilities, day tank and associated pipeline are indicated in **Figure 2.1**.

3.20 No chlorine gas or gaseous sodium hypochlorite would be emitted from the vent pipes of the storage tanks. The sodium hypochlorite would not vaporize and would not release chlorine gas in ambient temperature. When the storage tanks are being filled, only air in the headspace would be forced out of the vent pipe.

3.21 In view of no additional sewage/sludge conveying facilities involved in the chlorination facilities or extra open tank for sewage, therefore, no odour impact would be expected from the chlorination facilities.

Dechlorination Plant

3.22 The proposed dechlorination plant would include two sodium bisulphite storage tanks, chemical feed pump, chemical transfer pump and emergency generator set. Facilities in the dechlorination plant are chemical storage areas and associated dosing system. There is no additional sewage/sludge conveying facilities involved in the dechlorination plant.

3.23 Sodium bisulphite solution would be stored in tanks located next to Chamber No. 15. For sodium bisulphite solution, there are equilibria between $SO_2 + H_2O$, HSO_3^-, and SO_3^{2-} (i.e. $SO_2 + H_2O <==> H^+ + HSO_3^- <==> 2H^+ + SO_3^{2-}$), which depend on the pH and the acidic dissociation constants. At pH < 2, the equilibrium shifts towards $SO_2 + H_2O$, at 2<pH<7, the equilibrium shifts towards HSO_3^- and at pH > 7, the equilibrium shifts towards SO_3^{2-}. The pH of the sodium bisulphite solution provided by the chemical supplier would be around 4 and such pH will be well maintained in the storage tanks. Therefore bisulphite ion is the dominant species of the sodium bisulphite solution and no significant amount of sulphur dioxide gas would be formed and released.

3.24 Nevertheless, a fume recovery system would be provided for the vent pipe system of sodium bisulphite storage tank to further prevent the emission of sulphur dioxide gas (if any). The fume recovery system is a simple system consisted of containers filled with absorbent (e.g. activated carbon) and connected to the vent pipe. The gas released from the vent pipe will flow through the fume recovery system and any sulphur dioxide in the vent gas will be removed by the absorbent before it is released into the atmosphere.

3.25 The sodium bisulphite dosing system would be located below the wastewater surface at the chamber No. 15/drop shaft. . No sulphur dioxide gas emission would be expected. No odour emission would be expected from dischlorination facilities as there would no extra open tank for sewage treatment.

Prediction and Evaluation of Environmental Impacts

Construction Phase

3.26 Given the limited work areas, dust impacts at the representative ASRs would be low. Construction works are controlled by the Air Pollution Control (Construction Dust) Regulation, and mitigation measures such as watering are required under the regulation to limit dust emission. Typical dust control measures are presented in Section 3.29. With the implementation of dust suppression measures recommended in the Air Pollution Control (Construction Dust) Regulation, the dust impacts would be controlled within the relevant standards as stipulated in the EIAO-TM. During construction period, it is not necessary to provide temporary sewage facilities or any extra sewage exposed area. Therefore, no odour emission would be expected.

3.27 It is recommended that an Environmental Monitoring and Audit (EM&A) programme should be implemented during the construction phase to ensure that the dust criteria would be satisfied at the ASRs. Key EM&A requirements are presented in Section 12.

Operational Phase

3.28 As mentioned in Section 3.18 to 3.25, there would be no vapour emission from sodium hypochlorite and sodium bisulphite solutions identified during the operation of the chlorination/dechlorination facilities. Odour impact from these proposed facilities would not be expected.

Mitigation of Adverse Environmental Impacts

Construction Phase

3.29 Dust mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation should be incorporated to control dust emission from the site. Control measures relevant to this Project are listed below:

- Skip hoist for material transport should be totally enclosed by impervious sheeting;
- Vehicle washing facilities should be provided at every vehicle exit point;
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcore;
- Where a site boundary adjoins a road, streets or other areas accessible to the public, hoarding of not less than 2.4 m high from ground level should be provided along the entire length except for a site entrance or exit;
- Use of regular watering, with complete coverage, to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather;
- Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be applied to aggregate fines;
- Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs;
- Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations;
- Imposition of speed controls for vehicles on unpaved site roads. Ten kilometers per hour is the recommended limit;
- Every stock of more than 20 bags of cement should be covered entirely by impervious sheeting placed in an area sheltered on the top and the 3 sides;
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites; and
- Instigation of an environmental monitoring and auditing program to monitor the construction

process in order to enforce controls and modify method of work if dusty conditions arise.

Operational Phase

3.30 No odour impact or air quality impact arising from the operation of the Project would be expected. Therefore, mitigation measures are considered unnecessary.

Evaluation of Residual Impacts

Construction Phase

3.31 With the incorporation of Air Pollution Control (Construction Dust) Regulation and EM&A programme, adverse residual dust impact during the construction phase is not expected. Odour impact would not be expected as no temporary sewage treatment unit would be provided during construction.

Operational Phase

3.32 No residual air quality and odour impact is expected.

Environmental Monitoring and Audit

Construction Phase

3.33 With the implementation of mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation, dust levels at all ASRs would comply with the dust criteria. Details of the monitoring requirements are presented in the stand-alone EM&A Manual.

Operational Phase

3.34 No monitoring programme for operation of the Project would be required.

Conclusions

Construction Phase

3.35 Air quality impact from the construction of the Project has been assessed. With the implementation of mitigation measures specified in the Air Pollution Control (Construction Dust) Regulation, dust nuisance at ASRs would not be expected. An EM&A programme is recommended for the construction phase to ensure that the dust criteria would be satisfied at the ASRs. No odour emission was identified during construction of the Project.

Operational Phase

3.36 No air quality and odour impact was identified during operation of the Project. EM&A programme for operational phase is therefore not required.