

1. INTRODUCTION

Purpose of the Manual

- 1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set up of an EM&A programme for the implementation of the Environmental Impact Assessment (EIA) Study recommendations, to evaluate the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme for the construction and operation phases of the proposed project, namely “Harbour Area Treatment Scheme – Provision of Disinfection Facilities at Stonecutters Island Sewage Treatment Works” (hereinafter referred to as “the Project”). It aims to provide systematic procedures for monitoring, auditing and minimising environmental impacts associated with construction works and operational activities.
- 1.2 Hong Kong environmental regulations and the Hong Kong Planning Standards and Guidelines have served as environmental standards and guidelines in the preparation of this Manual. In addition, the EM&A Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on the EIA Process (EIAO-TM).
- 1.3 This Manual contains the following information:
- responsibilities of the Project Proponent, Contractor, the Engineer or Engineer’s Representative (ER), and Environmental Team (ET), Independent Environmental Checker (IEC), Drainage Services Department (DSD), Monitoring Team and Environmental Consultant (EC) with respect to the environmental monitoring and audit requirements during the course of the Project.
 - project organisation for the Project
 - the basis for, and description of the broad approach underlying the EM&A programme
 - requirements with respect to the construction programme and the necessary environmental monitoring and audit programme to track the varying environmental impact
 - methodologies to be adopted, including all field, laboratory and analytical procedures, and quality assurance and quality control programme (e.g. calibration of monitoring equipment)
 - definition of Action and Limit levels
 - establishment of Event and Action plans
 - procedures for environmental complaints handling
 - requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints
 - requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures
 - requirements for review of EIA predictions and the effectiveness of the mitigation measures / environmental management system and the EM&A programme
- 1.4 The ET leader, who shall be responsible for and in charge of the ET, is the person responsible for executing the EM&A requirements.

Project Description

Project Background

- 1.5 The Harbour Area Treatment Scheme (HATS) Stage 1 system, since its full commissioning in December 2001, has been preventing 600 tonnes of sludge from entering the Victoria Harbour each day and has brought about general water quality improvements in the harbour. Yet, the sewage generated from the most densely populated parts of Hong Kong Island, which currently accounts for about 25% of the sewage from the planned catchment of HATS, is only subject to preliminary

screening before discharge. This coupled with the effluent discharged from the Stonecutters Island Sewage Treatment Works (SCISTW) without disinfection, is the source of water quality problems in the western parts of the harbour. Moreover, with the anticipated growth in population and business activities in the harbour area, water quality would resume a deteriorating trend in future unless the sewage from Hong Kong Island is intercepted and treated, and the overall treatment level at Stonecutters Island is raised by completing HATS Stage 2.

- 1.6 After taking into account the public's views sought in a five-month consultation conducted in 2004, the Government announced on 22 April 2005 the programme for HATS Stage 2. The programme is to implement HATS Stage 2 in two phases, namely Stage 2A and Stage 2B. Under Stage 2A, deep tunnels will be built to bring sewage from the northern and western areas of Hong Kong Island to SCISTW. The treatment works will be expanded to provide centralized chemically enhanced primary treatment and disinfection for all sewage from the whole of the HATS catchment. Part of the Stage 2A disinfection facilities may be fast-tracked for completion in 2009. Under Stage 2B, a new biological treatment plant on a site adjacent to SCISTW is proposed.
- 1.7 Since the full commissioning of HATS Stage 1, although the overall bacteria (*E. coli*) levels in the harbour have been reduced by some 50%, the levels in the western harbour and the beaches along the Tsuen Wan coast have increased due to the discharge of large volume of treated but un-disinfected effluent off Stonecutters Island, resulting in closure of four gazetted beaches along the Tsuen Wan coast in 2003. As a result the Administration planned to advance the provision of part of the permanent disinfection facilities under HATS Stage 2A to improve the water quality in the western harbour area, for completion in 2009 to disinfect the treated effluent at SCISTW before discharge so that water quality along the Tsuen Wan coast can be improved. The purpose of the "Harbour Area Treatment Scheme – Provision of Disinfection Facilities at Stonecutters Island Sewage Treatment Works" (hereinafter referred to as "the Project") is to implement the above proposal.
- 1.8 The key elements of the proposed disinfection facilities, also termed the advance disinfection facilities (ADF) include:
 - (a) Chlorination system - provision of a sodium hypochlorite solution storage farm and associated dosing system; and
 - (b) Dechlorination system - provision of a sodium bisulphite storage and associated dosing system.

Project Location

- 1.9 The location plan of the proposed disinfection facilities at SCISTW is shown in [Figure 1.1](#).
- 1.10 The Project will be constructed within the existing sewage treatment works on Stonecutters Island, which is providing Chemically Enhanced Primary Treatment (CEPT) for 1.4 million cubic metres of sewage collected each day through deep tunnels from the HATS Stage 1 catchments (i.e. the whole of Kowloon peninsula, Tseung Kwan O, Kwai Chung, Tsing Yi, Chai Wan and Shau Kei Wan). The design treatment capacity of the SCISTW is 1.7 million cubic metres per day. At present, the plant has no disinfection facility and the CEPT treated effluent is now discharged to the waters southwest of Stonecutters Island through a 1.7 km long outfall.
- 1.11 The proposed chlorination system of the disinfection facilities would be located within the site boundary of the existing SCISTW ([Figure 1.1](#) refers). The proposed dechlorination plant would be located adjacent to the existing chamber no. 15 ([Figure 1.1](#) refers) at the western end of Container Port Road South.

Project Description

- 1.12 The technical review of disinfection technologies conducted for the Project shortlisted two technologies for detailed option evaluation: chlorination and UV radiation. Following the option evaluation process, the option of purchase of sodium hypochlorite solution was recommended as the preferred disinfection technology for HATS Stage 2.

- 1.13 The Project would involve the following major construction activities:
- Site formation & site establishment
 - Piling
 - Excavation and backfilling
 - Erection of formwork and reinforcement
 - Concreting
 - Fabrication of steelwork & installation of E&M equipment
 - Testing and commissioning
- 1.14 There would be no piling work for the construction of the dechlorination plant. The tentative construction programme is given in [Figure 1.2](#).
- 1.15 Under the recommended option of purchase of sodium hypochlorite solution for the HATS ADF, the existing effluent culvert system will be used as the chlorine contact basin. Sodium hypochlorite solution (v/v 10%-12%) as the disinfection agent will be dosed at the flow distribution chamber (see [Figure 1.1](#)) to achieve sufficient chemical mixing. Sodium bisulphite solution (v/v 38%) as the dechlorination agent will be dosed at the existing Chamber 15 prior to the outfall discharge (see [Figure 1.1](#)). The chemical storage tanks for the sodium hypochlorite solution will be rubber-lined steel tanks and that for sodium bisulphite solution will be fiberglass reinforced plastic tanks. Storage tanks for both solutions will be located inside bund walls.
- 1.16 Sodium hypochlorite solution will normally be delivered by barge to the SCISTW (by vehicles when weather or other conditions do not allow delivery by sea) at the proposed barge unloading facility. The sodium bisulphite solution will be delivered by road or tankers to the dechlorination plant.

Project Programme

- 1.17 It is intended to package the construction works for the Project under one contract and are tentatively scheduled to commence in March 2008 for completion in September 2009. The tentative construction programme is given in [Figure 1.2](#). Construction works would mainly take place at the chlorination plant and dechlorination plant locations.

Environmental Parameters to be Monitored

- 1.18 With reference to the recommendations made in the EIA Study, the environmental parameters to be monitored in construction and operation phases are presented as follows. The proposed monitoring programme is presented in subsequent sections of this EM&A Manual.

Construction Phase

- Air quality (dust) impact monitoring
- Noise impact monitoring

Operation Phase

- Water quality impact monitoring
- Human health and ecological risk evaluation
- Sediment quality monitoring and benthic survey

Project Organisation

- 1.19 The roles and responsibilities of the various parties involved in the construction phase and operation phase of the EM&A process and the implementation of the EM&A programme are outlined below.

The proposed project organisation and lines of communication during construction and operation phases with respect to environmental protection works are shown in [Figures 1.3](#) and [1.4](#) respectively.

Construction Phase

Project Proponent

- 1.20 The Project Proponent is the organization proposing the development of the Project. The Project Proponent should:
- Employ an Environmental Team (ET) to undertake monitoring, laboratory analysis and reporting of EM&A
 - Employ an Independent Environmental Checker (IEC) to audit the results of the EM&A works carried out by the ET

Engineer or Engineer's Representative (ER)

- 1.21 The term Engineer or Engineer's Representative refers to the organisation responsible for overseeing the construction works of the Project undertaken by various Contractors in accordance with the specification and contractual requirements. The ER should:
- Monitor the Contractors' compliance with contract specifications, including the implementation and operation of the environmental mitigation measures and their effectiveness
 - Monitor Contractors', ET's and IEC's compliance with the requirements in the Environmental Permit (EP) and EM&A Manual
 - Facilitate ET's implementation of the EM&A programme
 - Participate in joint site inspection by the ET and IEC
 - Oversee the implementation of the agreed Event / Action Plan in the event of any exceedance
 - Adhere to the procedures for carrying out complaint investigation

The Contractor

- 1.22 The term "Contractor" refers to all construction contractors and sub-contractors, working on site at any one time. Besides reporting to the Engineer, the Contractor should:
- Comply with the relevant contract conditions and specifications on environmental protection
 - Facilitate ET's monitoring and site inspection activities
 - Participate in the site inspections by the ET and IEC, and undertake any corrective actions
 - Provide information / advice to the ET regarding works programme and activities which may contribute to the generation of adverse environmental impacts
 - Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event / Action Plans
 - Implement measures to reduce impact where Action and Limit levels are exceeded
 - Adhere to the procedures for carrying out complaint investigation

Independent Environmental Checker (IEC)

- 1.23 The Independent Environmental Checker (IEC) should not be in any way an associated body of the Contractor or the ET for the Project. The IEC should be employed by the Project Proponent prior to the commencement of the construction of the Project. The IEC should have at least 10 years' experience in EM&A and have relevant professional qualifications, which shall include being an Accredited Monitoring Professional of the HKIEIA. The appointment of IEC should be subject to the approval of EPD. The IEC should:
- Provide proactive advice to the ER and the Project Proponent on EM&A matters related to the project, independent from the management of construction works, but empowered to audit the environmental performance of construction
 - Review and audit all aspects of the EM&A programme implemented by the ET
 - Review and verify the monitoring data and all submissions in connection with the EP and EM&A Manual submitted by the ET
 - Arrange and conduct regular, at least monthly site inspections of the works during construction phase, and ad hoc inspections if significant environmental problems are identified
 - Check compliance with the agreed Event / Action Plan in the event of any exceedance
 - Check compliance with the procedures for carrying out complaint investigation
 - Check the effectiveness of corrective measures
 - Feedback audit results to ET by signing off relevant EM&A proforma
 - Check that the mitigation measures are effectively implemented
 - Report the works conducted, the findings, recommendation and improvement of the site inspections, after reviewing ET's and Contractor's works, and advices to the ER and Project Proponent on a monthly basis

Environmental Team (ET)

- 1.24 The ET shall not be in any way an associated body of the Contractor, and shall be employed by the Project Proponent to conduct the EM&A programme. The ET should be managed by the ET Leader. The ET Leader shall be a person who has at least 10 years' experience in EM&A and has relevant professional qualifications, which shall include being an Accredited Monitoring Professional of the HKIEIA. The appointment of ET Leader should be subject to the approval of EPD. Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfilment of the Project's EM&A requirements as specified in the EM&A Manual during construction of the Project. The ET shall report to the Project Proponent and the duties shall include:
- Monitor and audit various environmental parameters as required in this EM&A Manual
 - Analyse the environmental monitoring and audit data, review the success of EM&A programme and the adequacy of mitigation measures implemented, confirm the validity of the EIA predictions and identify any adverse environmental impacts arising
 - Carry out regular site inspection to investigate and audit the Contractors' site practice, equipment/plant and work methodologies with respect to pollution control and environmental

mitigation, and effect proactive action to pre-empt problems

- Monitor compliance with conditions in the EP, environmental protection, pollution prevention and control regulations and contract specifications
- Audit environmental conditions on site
- Report on the environmental monitoring and audit results to EPD, the ER, the IEC and Contractor or their delegated representatives
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit levels in accordance with the Event and Action Plans
- Liaise with the IEC on all environmental performance matters and timely submit all relevant EM&A proforma for approval by IEC
- Advise the Contractor on environmental improvement, awareness, enhancement measures etc., on site
- Adhere to the procedures for carrying out complaint investigation

- 1.25 Sufficient and suitably qualified professional and technical staff should be employed by the respective parties to ensure full compliance with their duties and responsibilities, as required under the EM&A programme during the construction phase of the Project.

Operation Phase

Drainage Services Department

- 1.26 DSD will be responsible for the operation of the disinfection facilities and compliance with the conditions of the environmental permit during its operation. Besides, DSD should:
- Employ a Monitoring Team to undertake water quality monitoring, sediment monitoring, benthic survey, laboratory analysis and Whole Effluent Toxicity Tests (WETTs)
 - Employ an Environmental Consultant to analyze the monitoring results collected by the Monitoring Team

Monitoring Team

- 1.27 The Monitoring Team shall be managed by the Monitoring Team Leader to analyze the monitoring results. The Monitoring Team Leader shall be a person who has a degree in Chemistry, Biochemistry or other environmental-related discipline from universities and has sufficient post-graduate experience in chemical tests and ecotoxicity tests. Suitably qualified staff should be included in the Monitoring Team, and resources for the implementation of the monitoring programme should be allocated in time under the Contract, to enable fulfillment of the Project's monitoring requirements as specified in the EM&A Manual during operation of the Project. The Monitoring Team should:
- Monitor various environmental parameters and conduct various chemical tests, ecotoxicity tests and benthic survey as required in this EM&A Manual
 - Report on the environmental monitoring results to EPD, DSD and the Environmental Consultant or their delegated representatives

Environmental Consultant

- 1.28 The Environmental Consultant Team shall be managed by the Environmental Consultant Team Leader. The Environmental Consultant Leader shall be a person who has sufficient knowledge and experience in health risk, ecological risk and ecotoxicity assessment. Suitably qualified staff should be included in the Environmental Consultant Team, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfillment of the Project's EM&A requirements as specified in the EM&A Manual during operation of the Project. The Environmental Consultant should:
- Analyze monitoring results collected by the Monitoring Team
 - Prepare *Water Quality Monitoring Report* for each emergency discharge event
 - Prepare *Human Health and Ecological Risk Evaluation Report* based on the monitoring results collected to EPD and DSD for each set of operational phase monitoring
 - Prepare *Sediment Quality Monitoring and Benthic Survey Report* to EPD and DSD for each set of operational phase monitoring
 - Recommend suitable actions to DSD in case of exceedance of any health risk / ecological risk / ecotoxicity target level

Structure of the Report

- 1.29 Following this introductory section, the structure of the EM&A Manual is set out below:
- [Section 2](#) details the requirements for impact monitoring for dust during the construction phase.
 - [Section 3](#) details the requirements for impact monitoring of noise during the construction phase.
 - [Section 4](#) details the requirements for baseline and impact monitoring for water quality during the operation phase.
 - [Section 5](#) details the requirements for the human health risk evaluation during the operation phase
 - [Section 6](#) details the requirements for the ecological risk and ecotoxicity impact evaluation during the operation phase
 - [Section 7](#) details the requirements for the baseline and impact monitoring for sediment quality and benthic ecology during the operation phase
 - [Section 8](#) details the audit requirements with regard to waste management issues during construction phase.
 - [Section 9](#) describes the scope of environmental auditing and the complaints handling procedure.
 - [Section 10](#) details the EM&A reporting requirements.