12 IMPACT ON HUMAN HEALTH AND MAN-MADE ENVIRONMENT

Introduction

12.1 In response to the *Clause 3.4.8* of the EIA Study Brief, this section aims to review the likelihood of total residual chlorine (TRC) and chlorination by-products (CBPs) to be evaporated and dissolved in the rain, fog or atmospheric moisture to pose potential impacts on human health and man-made environment such as building materials.

Review of Impact of Atmospheric TRC and CBPs Deposits

12.2 Desktop study was carried out in order to identify any known or potential impacts of atmospheric TRC and CBPs deposits on human health and man-made environment. The following documents were reviewed:

- literature documents held in public libraries and tertiary institutions, including reference books and scientific journals; and
- technical documents or relevant project experiences found in the United States Environmental Protection Agency (USEPA), Environment Canada, European Environment Agency, The Netherlands Environmental Assessment Agency and World Health Organization (WHO).

12.3 From the desktop study, it was found that the research studies or projects related to TRC and CBPs were focused on (1) studying the chemistry and analysis techniques and (2) discussing the concerns about aquatic toxicity, human health impacts associated with drinking water. There are no research studies or projects on the impacts of atmospheric deposits of TRC and CBPs on human health and man-made environment, even though chlorine has been in continuous use for water disinfection since 1904 (Johnson & Jolley, 1987). Based on the above findings of the desktop study, it is suggested that impact of atmospheric TRC and CBPs deposits on human health and man-made environment up to date is not a concern issue to researchers and environmental authorities.

12.4 Apart from the desktop literature search, hazard of atmospheric TRC and CBPs deposits on human health and man-made environment associated with the operation of SCISTW is further discussed by evaluating (1) concentrations levels of TRC and CBPs in the effluent discharged from SCISTW and (2) physical properties of the contaminants.

12.5 According to water quality assessment results provided in Section 5, only trace levels of TRC and CBPs would be found at the edge of initial dilution zone (ZID) during the operation of SCISTW as shown in **Table 12.1**. The annual mean of TRC concentration would be 1.27 – 1.64µg/L. For the CBPs, only 8 and 5 of the documented potential CBPs were detected in the chlorinated and dechlorinated CEPT effluent and secondary treated effluent respectively in the chemical analysis program and their presences in the seawater would be very low, with concentrations less than 1µg/L.

Table 12.1 Estimated TRC and CBPs Concentration Levels at ZID

Contaminants	Annual Mean Concentration (μg/L)				
	Project Scenario 1	**Project Scenario 2**	**Project Scenario 3**	**Project Scenario 4**	**Project Scenario 5**
TRC	1.35	1.27	1.64	1.64	N.D.
Bromoform	N.D				0.80
Chloroform	0.09	0.09	0.12	0.12	N.D.
Dibromochloromethane	N.D.				0.13
Chloroacetic acid	0.05	0.05	0.07	0.07	N.D.
Dibromoacetic acid	0.05	0.05	0.07	0.07	0.16
Dichloroacetic acid	0.62	0.58	0.75	0.75	0.05
Trichloroacetic acid	0.30	0.28	0.36	0.36	0.12
Tetrachloroethylene	0.02	0.02	0.02	0.02	N.D
Trichloroethylene	0.03	0.03	0.03	0.03	N.D
2,4,6-trichlorophenol	0.03	0.03	0.03	0.03	N.D

Note: N.D. denotes not detected in chlorinated/dechlorinated CEPT effluent (for Project Scenarios 1 to 4) or chlorinated/dechlorinated secondary treated effluent (for Project Scenario 5)

12.6 The above contaminant concentrations are considered conservatively estimated due to the followings:

- The maximum contaminant concentrations in effluent were used to calculate contaminant concentration at edge of ZID
- The contaminants were assumed to have their concentrations decrease as a result of dilution and dispersion only, which other mechanisms including degradation were not considered

12.7 Literatures also supported that TRC is scarce in the air as it is mostly degraded in the water by self–decomposition (Hermanutz *et al*., 1987) and the attack of the seawater organics (Shams El Din *et al*., 2000). Therefore, there would be no concern about the atmospheric TRC deposits on human health and man-made environment.

12.8 For the documented potential CBPs listed in **Table 12.1**, only chloroform, dichloroacetic acid, tetrachloroethylene and trichloroethylene have a vapour pressure greater than 0.1mmHg at 25℃ which would partially evaporate and exist in the vapor phase in the atmosphere (USEPA, 1984; USEPA, 2004 and USEPA, 1989). Since only trace amount of CBPs would be present in the marine environment, it is considered that concentrations of CBPs in air associated with the chlorination and dechlorination process during the operation of SCISTW would be insignificant.

12.9 As stated in the Study Brief, one of the concerns about the atmospheric deposits of CBPs on man-made environment is the corrosion and damage of the building materials, which would be mainly caused by the acid rain. According to USEPA (2005), the cause of acid rain is known to be the oxides of sulphur and nitrogen, arising largely from the combustion of fossil fuels. The acids resulting from the formation of CBPs, such as haloacetic acids, are in very low concentration in air and would not be the main contributors in acid rain formation (Euro Chlor, 2005). Therefore, the impact of acid rain causing material corrosion and damage resulting from the atmospheric deposits of CBPs would not be expected.

Conclusions

12.10 As revealed in the findings of the desktop study with literature review, impact of atmospheric TRC and CBPs deposits on human health and man-made environment up to date is not an issue of concern. In addition, based on the evaluation of TRC and CBPs concentration levels in the effluent discharged from SCISTW estimated from the water quality assessment and physical properties of the contaminants, concentrations of TRC and CBPs in air would be insignificant and therefore, it is unlikely to have any potential human health and man-made environmental effects caused by atmospheric TRC and CBPs deposits.

References

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