

### Appendix 4.3 Generic Frequency Estimations

1. Based on the historical incidents review identified the accidents that involved the use of chlorine in water treatment works and the road transport of chlorine, the generic accident frequency can be estimated through the information of the number of water treatment works involved, the operating period and the total number of accidents occurred within the operating period.
2. The number of WTWs in HK, UK and the US are obtained through the accessible information, the estimated generic frequency data has been used for comparing the frequency applied in the 1992 SHW HA report.

#### Summary of accidents

3. The Major Hazard Incidents Data Service (MHIDAS) database is accessed and considered suitable for searching the chlorine related historical incidents. The number of chlorine release incidents during the MHIDAS time span of 44 years was used for the generic frequency estimation. 26 records of chlorine release were identified in the MHIDAS database.

#### Summary of number of WTWs

4. Based on the information from “Drinking Water in England and Wales 2007” by the Drinking Water Inspectorate and “American FactFinder” by the U.S. Census Bureau, the number of WTWs in England and Wales and the U.S. have been found as shown in Table 1 below.

**Table 1 Water Treatment Works Number and Density**

Region	No. of WTWs	Population Served	Average Population Served by a WTW
England and Wales	1,224	53,635,479	43,820
U.S.	4,603	287,888,021	62,544
Hong Kong	21	6,957,100	331,290
<b>Total</b>	<b>5,848</b>	<b>348,480,600</b>	<b>59,590</b>

#### Estimation of generic accident frequency from historical incidents review

5. It is assumed that all the water treatment works identified in Table 1 have been operating over the 44 years of the MHIDAS time span which the accidents occurred. The generic accidents frequency can be estimated by:

$$26 \text{ (incidents)} / (5848 \text{ WTWs} * 44 \text{ years}) = 1.01\text{E-}04 \text{ per plant-year}$$

#### Comparison of Frequency use in the Hazard Assessment

6. The sum of frequencies of all failure cases in the 1992 SHW HA report is 2E-03 per plant-year. The figure for SHW WTW is in order of magnitude to the estimated value from the historical incident. Thus, the frequencies in the SHW HA report are recommended to be adopted for the QRA of this study for a conservative approach.