Appendix E – Overview of Methyl Bromide Surface Water and Ground Water Monitoring

(i) Surface Water

The natural background concentration of methyl bromide in the oceans is in the ppb range. Monitoring data from 30 different global latitudes resulted in an average methyl bromide concentration of 1.2 ppb (U.S. EPA 1986). Slightly higher levels were detected off the coast of England (2.5-6.5 ppb), while lower levels (0.14 ppb) were observed off the coast of California (U.S. EPA 1986).

Methyl bromide levels are expected to be highest in streams or ponds that receive runoff from agricultural fields that have recently been fumigated with methyl bromide. Surface water in a greenhouse crop growing region of Malines-Antwerp, Belgium was sampled for the presence of bromide ion before, during, and after fumigation with methyl bromide. The maximum concentration of bromide ion in a brook downstream was reported as 9.6 ppm (IARC 1986). In nearby rivers, only a slight increase in the level of bromide ion was observed suggesting that the amount of methyl bromide contained in runoff leading to these waterways was small. The concentrations of methyl bromide and bromide ion were measured in irrigation water, drainage water, and surface water during the leaching periods in two Netherlands glasshouse soils after fumigation with methyl bromide (WHO 1995). Maximum concentrations in drainage water, determined within 24 hours of the start of leaching, were 9.3 ppm (methyl bromide) and 72 ppm (Br^-) (WHO 1995). Studies of the bromide ion concentrations in precipitation, surface water, and ground water in a horticultural district in the Netherlands in 1979-80 gave maximum values of 0.98, 41, and 17 ppm respectively, the highest concentrations being found during the main fumigation/leaching time in September-October 1979 (WHO 1995). The bromide ion was detected in surface water samples monitored by the USGS (USGS NAWQA). Surface water concentrations ranged from 0.061 to 15. 59 mg/L and were detected in two sampling sites only, Riverside and San Bernardino counties, California. Samples were collected intensively over a 2 day period in May 2001 and 2002. Methyl bromide and bromide ion concentrations in surface waters are summarized in Table 14.

Table 14. Concentrations of methyl bromide or bromide ion in surface waters.

Chemical	Concentration	Location	Source
Methyl bromide	9.3 ppm	Drainage water near a fumigated greenhouse in Netherlands	WHO 1995
	1.2 ppb	Average background level in oceans	U.S. EPA 1986
Bromide ion	72 ppm	Drainage water near a fumigated greenhouse in Netherlands	WHO 1995
	41 ppm	Surface water in a horticultural area	WHO 1995
	9.6 ppm	Maximum concentration in brook downstream of fumigated greenhouse in Belgium	IARC 1986
	0.98 ppm	Rainfall in a horticultural area	WHO 1995
	0.061 - 15.59 ppm	Surface water from monitoring sites; agricultural, urban, and mixed land uses	USGS NAWQA 2004

(ii) Ground Water

An analysis of the EPA STORET (Storage and Retrieval) database indicated that methyl bromide was infrequently detected in ambient water samples (1.4% of 941 samples) (Staples et al. 1985).

Methyl bromide is monitored in groundwater and surface water as part of the United States Geological Survey National Water Quality Assessment Program (NAWQA). A study summarizing NAWQA data from 1985 - 1995 found methyl bromide in 0.1% of the 2,948 groundwater sites sampled. Sites were selected to represent ambient water quality conditions. The maximum groundwater concentration was 0.5 ppb sampled in a rural watershed. The study did not state which watershed this was or whether it was impacted by agricultural activity.

Another study summarizing NAWQA data from 1992 to 1996 (Kolpin et al. 2000) reported detectable concentrations of methyl bromide in groundwater at a handful (i.e., 0.06%) of the 1,831 sampling sites. These sampling sites included domestic and public supply wells as well as springs and tile drains. The maximum concentration was 0.5 ppb .

USGS (http://water.usgs.gov/nawqa/) provides monitoring data on methyl bromide concentrations in water. No detectable concentrations were found in surface water (250 sites monitored), however, methyl bromide was detected in groundwater in 3 different watersheds. The complete data set is presented in Appendix D. Concentrations ranged from 0.10 - 0.50 ppb in urban and mixed-land use watersheds in Benton, Idaho, Richland, South Carolina, and Jefferson, Georgia, respectively. Detection frequencies for methyl bromide in wells at active and abandoned hazardous waste sites were reported for different EPA regions of the United States (Plumb 1992). In EPA Region 3 (Pennsylvania, West Virginia, Maryland, District of Columbia, and Delaware), methyl bromide was detected in 3.2% of the wells, while in EPA Region 9 (California, Nevada, Utah, Hawaii, Guam, Samoa, Northern Mariana Islands, and Trust Territories) it was detected in 0.8% of the wells. The bromide ion was detected in groundwater samples monitored by the USGS (USGS NAWQA). Groundwater concentrations ranged from 0.015 to 0.766 mg/L. In a comprehensive study of groundwater throughout the United States, EPA reported that methyl bromide was detected in only 2 out of 20,429 groundwater wells sampled from 1971-1991 (EPA 1992). Methyl bromide was not detected in any groundwater samples adjacent to fields that had been fumigated with this compound in 12 California wells (MRID 00152338) and 19 groundwater wells located in Florida (MRID 00152337). A table of all detected concentrations of bromide and methyl bromide in surface and groundwater is included in Appendix D of this report.