UNITED STATES GOVERNMENT

Memorandum

TO : Gerald F. Regan, Chief, Air Surveillance Branch

DATE: March 5, 1976

FROM : Technical Advisor, Special Projects Section
Air Surveillance Branch

SUBJECT: Calculation of PCB Air Emissions from Storage and Dispensing Operations at the Krummrich Plant of Monsanto

Potential air emissions from the storage and dispensing of PCB were calculated based on information supplied by Monsanto. The results of these calculations are:

Storage tanks for virgin product	- 597.4 kg/year
Product loading	- 0.0184 kg/year
Storage and handling waste aroclors	- 0.00066 kg/year

R. Edwin Zylstra

Attachment (Calculations)

MONS 029761

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Clarence Buckley of Monsanto estimated that storage and loading operations at the plant would displace the following volume of headspace gases:

1. Storage tanks 635,000 ft^3
2. Loading 460,000 ft^3

Calculation of emissions:

From Fig. 2.2 from the Draft Mitre report the vapor pressure of Aroclor 1242 is 3 mm Hg at 100°C and 10^{-4} at 21°C. The aroclors are stored at 100°C. It may be assumed that the temp. in the tanks being loaded would be approximately 70°F (21°C).

From Dolton's law of partial pressure:

$$Bx = \frac{Px}{P\ mix.}$$ where Bx = proportion by volume of a gas component

Px = partial pressure of gas component and
P mix. = absolute pressure of gas mixture.

$$Bx = \frac{3}{760} = \frac{0.0039}{1}$$ or 3900 ppm at 100°C

To change ppm to mg/M^3 use the following formula:

$$mg/M^3 = ppm \times \frac{mol.\ wt.}{molecular\ volume}$$

mol. wt. = 261

molecular volume = 30.62 liters/mol. at 100°C

$$mg/M^3 = 3900 \times \frac{261}{30.62} = 33242$$

Emissions from storage tanks:
Emissions kg/year = Vol. of gas displaced/year x concentration of PCB

$$Kg/yr = 635000\ ft^3 \times .0283 \frac{M^3}{ft^3} \times 33242 \times \frac{1\ kg}{10^6\ mg}$$

kg/year = 597.4

Emissions from loading operations:

$$Bx = \frac{Px}{P\ mix.} = \frac{10^{-4}}{760} = 1.3 \times 10^{-7}$$ or .13 ppm

$$mg/M^3 = .13 \times \frac{261}{24.04} = 1.41\ mg/M^3$$

Emissions:

$$\text{Kg/yr.} = 460{,}000 \times .0283 \times 1.41 \times \frac{1\ \text{kg}}{10^6\ \text{mg}}$$

$$\text{Kg/yr.} = 0.0184$$

Emissions from handling of waste aroclors:

Total waste material received into plant as reported by Monsanto for 9 mos. of 1975 - 1,431,000 lbs. Assume that all this material is received and stored at 70°F and that it displaced an equal volume of tank headspace gas at 70°F.

$$\text{Volume of produce} = 1{,}431{,}000\ \text{lbs.} \times \frac{1\ \text{gal.}}{11.5\ \text{lbs.}} \times 3.785\ \frac{\text{liter}}{\text{gal.}}$$

$$\frac{1}{X10^3\ \frac{\text{liters}}{M^3}} = 471\ M^3$$

The concentration would be the same as in the loading operation that is 1.41 mg/M3.

Emissions:

$$\text{Kg/yr.} = 471\ M^3 \times 1.4\ \text{mg}/M^3 \times \frac{1\ \text{kg}}{10^6\ \text{mg}}$$

$$\text{Kg/yr.} = .00066$$