

Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Background Report Reference

AP-42 Section Number: 10.8

Background Report Section: 4

Reference Number: 8

**Title: Engineering Calculation of
Pentachlorophenol Air Emissions at Wood
Preserving Facilities**

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August 31, 1992

Vulcan Chemicals
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*Engineering Calculation
Of Pentachlorophenol Air Emissions
At Wood Preserving Facilities*

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August 31, 1992

This report is intended to provide information to EPA in support of Vulcan Chemicals' position that pentachlorophenol wood preserving facilities should be removed from consideration as a major source category under the Clean Air Act Amendments of 1990.

Included as Exhibit 1 of this document are the actual Form R background data and computations for a medium/large sized wood preserving facility. The facility name has been removed.

This discussion will focus on the pentachlorophenol treating system, but the emissions of creosote components are included in the Form R data in Exhibit 1.

Key factors in determining the emissions are the process parameters that determine the volume of air released that is subject to contain the hazardous air pollutants.

Information must be obtained on the number of charges of material treated with each preservative, the process cycle followed, the volume of preservative used, the size of the treating vessel, the average charge (or batch) size, the size of the tanks used, the percent strength of the treating solution, and the temperature of the various tanks and process equipment.

Fugitive emissions from process piping and fluid transport systems were based on a typical piping configuration. This over estimates the releases because it assumes that the material leaking from the flange, valve, or pump volatilizes, which in reality it does not. Leaks occur in the form of

liquid, which would be subject to evaporation of specific components based upon a mole fraction and vapor pressure relationship.

At pentachlorophenol facilities, the percent by weight of pentachlorophenol in the preservative solution must be known. In addition, facilities buying raw material in 40% concentrate form will have to perform separate calculations for the concentrate tank losses.

A typical pentachlorophenol wood preserving facility has no air emission control devices on any of its tanks or process vents. The Form R computations involve computation of total air releases from the process. This air is assumed to be in equilibrium with the preservative solution, and releases are calculated based upon standard engineering equations using vapor pressures.

The results of the engineering estimates for an actual plant found in Exhibit 1 show estimated pentachlorophenol releases of less than 5 pounds.

The only potential air source not included in the Form R estimate is the finished product storage. Instructions with the Form R reporting package state that normal releases from finished goods are not to be considered releases for Form R reporting purposes.

For purposes of establishing a very conservative estimate of pentachlorophenol emissions from finished goods storage, the following discussion is provided.

Assume that a typical large pentachlorophenol wood preserving process manufactures 4,000 cubic feet of treated wood each day, and that 6 weeks, or 30 production days of finished goods inventory is maintained. A total of 120,000 cubic feet of treated material is on hand. A typical utility pole is 40 feet long, with a volume of approximately 20 cubic feet, so there are 6,000 poles on hand. The same typical 40 ft. utility pole will have a 7 inch diameter top and an 11 inch diameter base, giving it a surface area of approximately 95 square feet. The total surface area is then 570,000 square feet.

The surface of pentachlorophenol treated utility poles is dry, but for estimating purposes, the theoretical air emissions from a 570,000 square foot liquid surface will be made. A method found on page 6-4 of EPA's "Estimating Releases And Waste Treatment Efficiencies For The Toxic Chemical Release Inventory Form", EPA 560/4-88-002, will be used. This method is used to calculate air emissions from a liquid chemical spill. The following equation is used:

$$W = \frac{MKAP^*}{RT}$$

Where: W = vapor generation rate lb./sec.
M = molecular weight of chemical
A = area of spill
P* = vapor pressure of chemical
(for mixtures, use partial pressure)
R = universal gas constant, 10.73 psia - ft.³/°R - lb.mole
T = temperature of liquid, °R = °F + 460
K = gas phase mass transfer coefficient, ft./sec.

$$K = .00438(U)^{.78}(18/m)^{1/3} \text{ ft./sec.}$$

Where: U = wind speed, miles/hr.

M = molecular weight

In the above, substitute 570,000 square feet for the area, 80°F for the average temperature, 5 miles per hour for the wind speed, and 266.32 for the molecular weight of pentachlorophenol. Given these, K computes to .0063 ft./sec. Assuming a treating solution strength of 8.5%, the partial pressure for pentachlorophenol becomes 2.15×10^{-7} psia.

Substituting these values into the above equation yields:

$$W = \frac{(266.32)(.0063)(570,000)(2.15 \times 10^{-7})}{(10.73)(540)}$$

$$W = 3.54 \times 10^{-5} \text{ lb./sec.,}$$

or 1,119 lbs./year.

The above is the equivalent of 13 acres of free liquid surface and could be expected to be a grossly conservative estimate of potential emissions from treated product storage. This can be verified by estimating preservative loss over time. If 120,000 cubic feet of material loses 1,119 lb./year, then the loss is .0093 lb./cubic foot/year. Most utility poles are treated to a retention of .38 pounds of pentachlorophenol per cubic foot in accordance with American Wood Preservers Association standards. If preservative loss occurred at .0093 lb./cubic foot/year, then the preservative would be totally gone in 40.75 years. Numerous published reports of poles removed

from service have shown that the vast majority of preservative still remains in the pole.

Given the Form R data enclosed, and the conservative computation of storage yard releases, the total air emissions of pentachlorophenol are still only about 5% of those necessary for designation as a major source.