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## Chloroform in Ketchikan: Residents can sleep easy!

**Statement of the Problem:** As a result of agreements between the Ketchikan Pulp Company (KPC) and State and federal regulatory agencies, the KPC prepared an environment risk assessment of airborne emissions in Ketchikan.<sup>1</sup> The risk assessment was developed by using estimates and models, not from actual measurements. Significant cancer risks to residents in Ketchikan were calculated; chloroform inhalation was the primary contributor to the overall cancer risk.<sup>1</sup> Because this report generated concern among residents living near KPC, we present here a preliminary assessment of the chloroform cancer risk to residents in Ketchikan.

**Review of the Issue:** To prepare the KPC risk assessment and derive an estimate of the cancer risk from chloroform inhalation, the estimated chloroform concentration in air was multiplied by the chloroform inhalation cancer potency factor. The chloroform cancer potency factor (the risk of cancer as a function of exposure concentration) was obtained using the Integrated Risk Information System (IRIS), a database of cancer risks compiled by the US Environmental Protection Agency. To estimate a human inhalation cancer potency factor for chloroform, an extrapolation was made using rat experiments where chloroform was given orally.<sup>2</sup> The oral cancer risk from chloroform exposure was then converted to an inhalation cancer risk by assuming a daily volume of inspired air (20 m<sup>3</sup>) and an average body weight (70 kg). Human exposure was assumed to occur every day for 70 years. Estimated chloroform concentrations in air within and around KPC were calculated using a mathematical dispersion model of atmospheric discharge from KPC.

After estimating cancer risks from all exposures, chloroform was the compound of highest carcinogenic concern, causing 87% of the total excess calculated cancer risk from KPC emissions. At the worst-case location, the average annual ground-level chloroform concentration was calculated as 7.5 µg/m<sup>3</sup>, with a corresponding estimated excess cancer risk of approximately 1 in 5800. For comparison, the regulatory cancer risk level established by the Alaska Department of Environmental Conservation is 1 in 100,000 or less.

**Response:** In reviewing the KPC chloroform cancer risk estimate, several issues need consideration. Chief among these issues is the choice of the cancer potency factor. While the EPA revised and lowered the oral cancer potency factor for chloroform, the EPA has not yet revised the inhalation potency factor. If the recently revised oral chloroform potency factor<sup>3</sup> were employed in the inhalation cancer risk calculation, the worst-case estimated excess cancer risk would be lowered from 1 in 5800 to 1 in 77,000. Also, the proportion of locations estimated to exceed a 1 in 100,000 cancer risk (as determined by analyzing 431 grid points encompassing KPC and the surrounding area) would be lowered from 22% to less than 0.5%. This represents a substantially reduced estimated risk.

Another issue in the risk calculation lies with the use of a mathematical dispersion model to calculate ground-level chloroform concentrations. Because it is not possible to assess the accuracy of the estimated chloroform exposure concentrations with the information at hand, the dispersion model remains unverified.

Finally, the assumptions made in deriving the worst-case exposure scenarios (i.e. life-time residential exposure at the highest exposure concentrations) are not realistic. As a result, the calculated cancer risk found in the KPC assessment greatly over estimates the risk of cancer.

The cancer potency factor for chloroform will likely undergo further reduction in the future.<sup>4</sup> Recent findings show a lack of cancer in animals exposed to chloroform concentrations which are representative of environmental concentrations.<sup>4</sup> As scientific understanding of chloroform toxicity evolves, it appears that chloroform is not as potent a carcinogen as once believed.

**Conclusion:** Based on available information, it is the preliminary assessment of the Section of Epidemiology that atmospheric chloroform emissions from KPC do not present a significant health risk to residents in Ketchikan. Our conclusion is based on the fact that the assumptions made in the calculated health risk assessment do not reflect realistic exposure scenarios, and that the cancer potency factor for chloroform used in the risk calculation over-predicts risk.

(Submitted by Rafael Ponce, Ph.D. Toxicologist, Section of Epidemiology.)

**Table 1: Effect of cancer potency factor on the percentage of sites which fall into any of three cancer risk categories.** Sites correspond to grid locations used in dispersion model analysis.

	< 1 in 1,000,000	1 in 1,000,000 to 1 in 100,000	> 1 in 100,000
NCP <sup>2</sup>	43.16%	35.03%	21.81%
Jorgenson <sup>3</sup>	80.51%	19.03%	0.46%

1. Alaska Department of Environmental Conservation Rules 50.110 and 50.400 (c)(2) Compliance Showing Report, March 1995, Submitted by Ketchikan Pulp Company (Prepared by the Radian Corp.).
2. National Cancer Institute (1976) Report No. (NIH) 76-1279. PB-263 018, Bethesda, Md.
3. Jorgenson et al. (1985) *Fundam. Appl. Toxicol.*, **5**, 706.
4. News and Comment (1995) *Science*, **268**, 356.