

## **Appendix B. Benzene Cancer Risk Estimates**

The NYSDEC Annual Guideline Concentration (AGC) for benzene is based on a Unit Risk Estimate for cancer effects. The AGC value is 0.13  $\mu\text{g}/\text{m}^3$  (0.04 ppb) and it is used to protect the public from an additional “one-in-one-million” risk of contracting cancer over a lifetime of continuous exposure. The source for the value is USEPA’s Integrated Risk Information System<sup>1</sup>.

### **Unit Risk Estimate - discussion of confidence**

The unit risks and/or risk-specific concentrations derived by authoritative bodies for benzene are largely based on the increased incidence of leukemia in human occupational exposure studies. All of these analyses apply some form of linear-low dose extrapolation model (a) to the epidemiological data, assuming a non-threshold mode of action for the cancers observed in the occupational study group. The non-threshold approach to carcinogenic risk assessment assumes that any exposure to a carcinogenic agent carries with it an increased risk for cancer, although the risk may not be quantifiable or lead to developing the disease. The use of a linear model is a default public health protective approach used by governmental agencies. The true risk could be either be higher or lower depending on the recognition of supralinear (b) and sublinear (c) relationships at low doses and non-threshold or threshold modes of action on exposure to benzene.

(a) The risk is strictly linear (risk is directly proportional to dose). This is called the Linear No-Threshold (LNT) model.

(b) supralinear extrapolation is where risks at lower doses are higher per unit dose than if one extrapolated linearly from, for example, the higher doses experienced by the A-bomb survivor data.

(c) sublinear extrapolation is where risks at lower doses are lower per unit dose than if one extrapolated linearly.

### **Air monitoring data**

Although we have prepared comparison estimates of the Unit Risk Estimate with the first six months of air monitoring data, we urge caution in interpreting these values. AGCs are intended to be protective of long-term exposure to a contaminant’s air concentration. It is most appropriate to compare annual average results for an air contaminant with the AGC values. Additionally, studies have shown that benzene levels can vary by season. Therefore, it would not be unexpected, if the next six months of data January – June 2008, vary from our first six months, assuming no change from local source contribution.

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<sup>1</sup> <http://www.epa.gov/ncea/iris/subst/0276.htm#suminhal>

### Comparison to Unit Risk Estimate

We compared the six month average for all four Tonawanda study air monitors. We also are providing comparisons to the statewide average and a comparison to a monitor in a rural location as shown in Table 1. The cancer risk estimate is the number of cases predicted per one million exposed individuals over a lifetime exposure.

**Table 1. Benzene Cancer Risk Comparison**

<b>Site</b>	<b>Description</b>	<b>Estimated Cancer Risk (on a per million basis)</b>
Grand Island Blvd	Central site monitor located nearest industrial sources	88
Sheridan Park Water Tower	Northern edge of a residential community	8
Brookside Terrace	Located in a residential community Northeast of industrial sources	14
Beaver Island State Park	Background site, upwind of the Tonawanda industrial area	9
NYS annual average for 2007		7
Whiteface Mountain annual average 2006	Base of Whiteface Mountain, remote from industrial sources	3