

Benzene Canada-wide Standard: 2008 Update

Introduction

In June, 2000, the Canadian Council of Ministers of the Environment (CCME) endorsed the Canada-wide Standard (CWS) for Benzene, Phase 1. In September 2001 CCME further endorsed the Canada-wide Standard (CWS) for Benzene, Phase 2. CCME recognized that implementation of the Standard would reduce Canadians' exposure to this non -threshold human carcinogen. In Phase 1 Ministers committed to reducing national benzene emissions by 30% (15.3 kilotonnes) between the 1995 base year and 2000. With Phase 2 Ministers committed to reducing benzene emissions from existing sources by an additional 12% (6 kilotonnes) by 2010, while minimizing emissions from new sources, for a total of a 42% reduction in benzene emissions between the base year 1995 and 2010. All Ministers, except Quebec, signed this Standard. Individual jurisdictions pursued emission reductions through specific actions related to components of the Oil and Gas, Transportation, Petroleum Refining, Chemical Manufacturing, and Steel Manufacturing sectors. This report documents the attainment of the CWS seven years ahead of schedule.

National Reductions in Benzene Emissions

Based on reported and estimated emissions data, it is estimated that benzene emissions in Canada decreased by 67% between 1995 and 2003. The contribution of various sectors to this emissions reduction is shown in Table 1.

Table 1
Reduction in Benzene Emissions Achieved in Canada: 1995 - 2003

Sector	Emissions (kt)			Reductions (1995-2003)	
	1995 ^{a)}	1999 ^{a)}	2003 ^{b)}	%	kt
Chemical Manufacturing Plants	0.44	0.18	0.08	81.8	0.36
Steel Manufacturing – Steel Mills	1.2	0.72	0.37	69.2	0.83
Petroleum Refining (including oil sands)	0.44	0.26	0.25	43.2	0.19
Petroleum Distribution	0.5	0.5	0.40	20.0	0.1
Upstream Oil and Gas – Natural Gas Dehydrators ^{c)}	8.74	4.01	1.99	77.2	6.75
Residential Wood Combustion	4.34	4.56	2.87	33.9	1.47
Transportation – On Road Vehicles	30	15.60	10.38	65.4	19.62
Miscellaneous Combustion	4.7	4.8	0.48	89.8	4.22
Prescribed Burning	0.5	0.4	0.1	80.0	0.4
Other Sources Reporting to NPRI	n/a	0.25	0.1	60.0	0.15
Total	50.86	31.28	17.02	67.0	33.84

a) "Benzene Canada-wide Standard Phase 1- National Summary Annual Progress Report", CCME, 2002.

b) "Canadian Benzene Emissions Inventory for 2003", ChemInfo, 2006.

c) "Status Report – Benzene Emissions from Glycol Dehydrators", CAPP, 2005.

The commitments under the two phases of the CWS equate to achieving an emissions reduction of 21.3 kilotonnes from 1995 levels by 2010. Based on the information in Table 1, this emissions reduction was actually achieved by 2003. The greatest reductions came from on road vehicles and from natural gas dehydrators. There is high uncertainty in the estimation of “Miscellaneous Combustion”, which includes pulp and paper, wood products, landfills and general combustion. The reduction in emissions from the Miscellaneous Combustion sector may be due to emissions estimation methodology rather than actual decreases in quantity of emissions. Significant percentage reductions were also achieved by the chemical manufacturing, steel manufacturing and petroleum refining industries. However, there is a need for ongoing monitoring and emissions management especially in the areas experiencing increasing industrial or population growth.

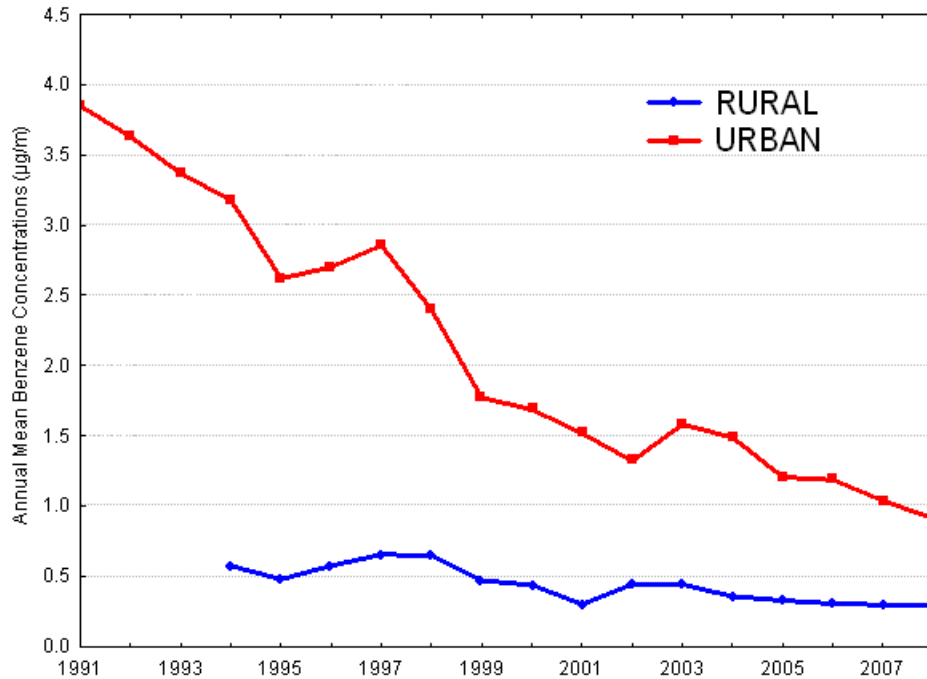
National Ambient Concentrations of Benzene

Benzene is measured as part of the National Air Pollution Surveillance (NAPS) network. Through the NAPS network, data are collected on ambient air levels of a variety of toxics at rural, suburban, city-centre and industrial sites. This effort is carried out in cooperation with provincial and municipal environmental agencies. In 2004 there were 51 active sites where benzene measurements were taken. Thirteen sites were in rural locations and the other 38 sites were located in 18 different cities across Canada. For the urban sites the annual means ranged from 0.4 to 7.6 $\mu\text{g}/\text{m}^3$, with 35 of the 38 sites recording annual mean concentrations less than 2.0 $\mu\text{g}/\text{m}^3$.

The NAPS benzene monitoring program began in 1989. For the period 1991 to 2008 there were 20 urban sites in 12 cities that had complete annual data records. The composite annual mean for that group of sites is shown on Figure 1. Also shown on the graph are results for a group of rural sites that had complete data for 1994 to 2008.

During the period 1994-1996 urban benzene concentrations averaged 2.5 $\mu\text{g}/\text{m}^3$, while between 2000 and 2004 urban concentrations averaged 1.4 $\mu\text{g}/\text{m}^3$. This corresponds to a 44% reduction in ambient concentrations over that period. Rural benzene concentrations decreased by approximately 40% over the same time period.

Figure 1
Trend in Annual Mean Benzene Concentrations ($\mu\text{g}/\text{m}^3$) for Urban and Rural Locations (1991-2008)



Conclusions

Canadian emissions of benzene fell by 67% between 1995 and 2003, meeting the CWS Phase 2 target that was to be achieved by 2010. Ongoing initiatives in the natural gas industry and the transportation industry are likely to result in small additional reductions in benzene emissions from those sectors. The emissions data presented here also demonstrate that the provisions of the CWS for minimizing benzene emissions from new and expanding facilities, through the application of best available pollution prevention and control techniques, have been successful.

The reduction in emissions is reflected in reduced ambient concentrations observed in both urban (-76% between 1991 and 2008) and rural (-50% between 1994 and 2008) locations in Canada. The reduced ambient concentrations have achieved the Ministers' goal of reducing the health risk to Canadians from benzene. Ambient benzene levels will continue to be monitored through the NAPS network and reported annually on the CCME website.

Given the success achieved both in reducing emissions of benzene and in reducing ambient concentrations of benzene, the goals of the Benzene CWS have been achieved.