Air emissions from the Chevron North Burnaby refinery: Human health impact assessment

Summary

What was the purpose of this work?
A team of researchers from the School of Occupational & Environmental Hygiene at the University of British Columbia was asked to assess the human health impact of air emissions from the Chevron refinery in North Burnaby. The terms of reference were developed by an advisory committee including representatives from local, provincial and federal agencies, Chevron Canada and community members. The objective was to perform an assessment of the potential human health impacts of current air emissions from the refinery, tank farm and associated facilities.

What did we do?
We reviewed the results of all available community air monitoring for common air pollutants (particulate matter, sulphur dioxide, nitrogen oxides, carbon monoxide, and ozone), total reduced sulphur compounds and volatile organic compounds. We used data from 1998, 1999, and 2000, collected by the Greater Vancouver Regional District and Environment Canada. We compared concentrations at two monitoring stations in North Burnaby (one adjacent to the refinery tank farm and one located on Capitol Hill overlooking the refinery) to concentrations in other residential neighbourhoods in the GVRD and to concentrations found at monitoring locations close to other refineries in Canada. Standard risk assessment techniques were followed, modified where necessary to address questions posed by the community, rather than regulatory objectives. When the air monitoring data indicated elevated concentrations of pollutants in North Burnaby compared to elsewhere in the GVRD, we carried out detailed reviews of scientific literature to identify potential health impacts of exposure to the pollutants at the levels seen in this community. We also received over 150 comments from community members that helped in preparing our report.

What did we find?

Particulate matter, carbon monoxide, nitrogen dioxide, ozone

We found that levels of particulate matter, carbon monoxide, nitrogen dioxide and ozone were similar in North Burnaby to other residential areas in the GVRD. Therefore, we would not expect that residents of North Burnaby would experience additional health consequences because of exposure to these substances, compared to other GVRD residents.

Sulphur dioxide

We found that 1-hour peak concentrations of sulphur dioxide were more frequent at the Capitol Hill monitoring location than at any other monitoring location in the GVRD. The 1-hour concentrations at Capitol Hill exceeded the GVRD maximum acceptable concentration on 1 occasion and exceeded the GVRD maximum desirable concentration 21 times on 6 separate days. With respect to the potential health consequences of these peaks, we estimated that about 15 to 35 North Burnaby residents with asthma might experience a worsening of their asthma on any one of about 25-30 days each year as a result of exposure to sulphur dioxide.
result of sulphur dioxide peaks. Although concentrations were high enough to affect residents with asthma, they are unlikely to have a significant impact on residents without asthma. Also, concentrations of sulphur dioxide averaged over 24 hours were not significantly elevated compared to other areas in the GVRD.

*Reduced sulphur gases*

Reduced sulphur gases are compounds that smell like rotten eggs or rotten cabbage at very low concentrations. We found that levels of these reduced sulphur gases in North Burnaby were higher than at other residential areas in the GVRD but lower than at the Port Moody monitoring station. The levels were not sufficiently high to contribute to symptoms or disease, but were frequently high enough to result in odour annoyance.

*Volatile organic compounds*

We found that average concentrations of volatile organic compounds characteristic of petroleum fuels were over 5 times higher in the area near the tank farm than elsewhere in the GVRD, and also higher than levels around other Canadian refineries used for comparison purposes in this project. Levels of gasoline vapour (a mixture of volatile organic compounds) were sufficiently high to result in odour annoyance to neighbouring residents. Concentrations were well below levels linked to respiratory and eye irritation in animals, but the size of the margin of safety for humans is unclear from the information available in the scientific literature.

We carried out a detailed review for over 150 individual volatile organic compounds. The highest levels were at or near relevant health based comparison values for 6 compounds. Of these, only 2 (benzene and 1, 3 butadiene) were found at levels that may result in a real health impact in the population. Benzene is regarded as a proven human carcinogen, 1, 3 butadiene is regarded as a probable human carcinogen. However, both these substances are present throughout the GVRD in both outdoor and indoor air. Based on the outdoor concentrations in North Burnaby, we estimated that the exposures to benzene and 1, 3 butadiene from the refinery and tank farm would result in less than one single excess cancer among all residents of the surrounding area over a period of about 70 years.

We also reviewed the results of 26 epidemiology studies from other refinery communities and found results consistent with our report. A small number of studies did find an increase in odour complaints and, to a lesser extent, irritative symptoms, in association with residence nearby to oil refineries.

**What did we recommend?**

We made some recommendations about air quality monitoring and reporting in the future, but did not make recommendations about how emissions from the refinery should be controlled or what should be the acceptable concentrations of pollutants in neighbourhood air. We believe that these decisions should incorporate social as well as scientific input, and should be made in consultation with stakeholders and the community.

**Where can you get more information?**

A detailed report has been provided to the City of Burnaby, the GVRD, BC Ministry of Water Lands and Parks, Environment Canada, Burnaby School trustees, Simon Fraser Health Region, Chevron Canada, and advisory committee members of the community. It is also available for reading and downloading from our website at: [http://www.interchg.ubc.ca/burnaby/](http://www.interchg.ubc.ca/burnaby/).

**Study team:** Dr. Susan Kennedy, Dr. Ray Copes, Sarah Henderson, Sonia Na, Dr. Colin MacKay