Health Review and Response

to

James Bay Phase III Air Quality Monitoring

Provided By:

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Introduction:

In 2006, the James Bay Neighbourhood Association (JBNA) contacted the Vancouver Island Health Authority (VIHA) requesting information about cruise ship traffic at Ogden Point in the Port of Victoria, the associated air emissions and the possible effects on the health of neighbourhood residents. In response, VIHA established a partnership of interested parties and researchers, including the Greater Victoria Harbour Authority (GVHA), the Capital Regional District (CRD) air quality staff, Ministry of Environment (MOE) air quality staff, the JBNA and the University of Victoria.

A preliminary air quality study was designed and conducted by University of Victoria researchers Dr. Eleanor Setton and Karla Poplawski with assistance from SENES Consulting and grants and/or equipment from MOE, Ministry of Healthy Living and Sport (MHLS), the Clean Air Research Fund, VIHA and the Greater Victoria Harbour Authority. The results of this work are summarized in two reports:

1) James Bay Air Quality Study: Phase I Report on the Results of Field Monitoring in 2007, dated 2008.

2) James Bay Air Quality Study: Phase II Report on the Results of CALPUFF Air Quality Dispersion Modeling 2007, dated 2009.

   Both reports can be found at www.viha.ca/mho/publications/

These first two phases produced a spatial analysis of emissions from the port area with predicted concentrations of pollutants in the James Bay community and vicinity, taking into account both background sources as well as those emanating from cruise ships entering, docked and leaving the port. Analyses of data from the provincial air quality monitoring station (Topaz) located three kilometers NNE of the Victoria harbor in Saanich were also included for 2006 and 2007. At VIHA's request, Dr. Tom Kosatsky, Medical Director, Environmental Health Services, BC Center for Disease Control (BCCDC), Scientific Director, National Collaborating Centre for Environmental Health, and Clinical Associate Professor, School of Population and Public Health, UBC, provided health input on the findings and made presentation to a community forum on December 10, 2008.

Following the first two studies, the researchers and BCCDC recommended adding measures of short-term (10 minute and 1 hour) average concentrations of sulfur dioxide (SO_2) based on the fact that analysis of the data and model results to date indicated potential for short term peaks

in SO_2 concentrations. Short term exposures to SO_2 have been the basis for international regulatory guidelines since 2005.

The former CRD Air Quality Working Group requested that in addition to the regular annual CRD Air Quality Report for 2008, that data for SO_2 be evaluated using data from the Topaz station to confirm the SO_2 signature related to cruise ship activity in 2008. This CRD 2008 annual report is:

3) **2008 Annual CRD Air Quality Report, SENES Consultants, November 2009**

This report can be found at www.crd.bc.ca/airquality/index.htm

In 2009, an opportunity to utilize newly-acquired MOE air monitoring equipment provided the means to measure 10 minute, 1 hour and 24 hour levels of SO_2 in James Bay. This third monitoring phase utilized a continuous air monitoring trailer, called the Mobile Air Monitoring Laboratory (MAML). MAML was positioned in an area of James Bay predicted in the *Phase II Report* as a location optimally suited to capture SO_2 levels. Data were collected over a significant portion of the 2009 summer cruise ship season for the purpose of further defining air pollutant levels in James Bay. As well, SO_2 data collected at the Topaz monitoring location in summer 2009 were summarized by the University of Victoria researchers in this report:

4) **MAML-James Bay Air Quality Study- Data Collection Report, 2009, 2010 (referred to as *MAML Report* in this document)**

This report can be found at www.viha.ca/mho/publications/

Preliminary information from this study was presented to the James Bay Neighbourhood Association and the Greater Victoria Harbour Authority in the fall 2009, and shared with the CRD as part of the development of their annual air quality report.

Upon the finalization of the MAML report, I was – in my capacity as Chief Medical Health Officer for the Vancouver Island Health Authority – asked to review and respond to the MAML data to provide a public health assessment and make recommendations on actions to mitigate potential health impacts.

Assessment:

My report, *Health Review and Response to James Bay Phase III Air Quality Monitoring* is based on the 2009 data described in the *MAML Report* and on the analysis of the SO_2 concentrations summarized in Appendix D of the 2008 CRD annual report for the summer of 2008.

In developing my response and recommendations, I consulted with Dr. Tom Kosatsky, Medical Director, Environmental Health Services, BCCDC. Areas where Dr. Kosatsky provided advice are referenced in this report.

James Bay has a resident population of approximately 11,000 people. This neighbourhood is one of the older populations in the City of Victoria. Generally, the residents can be considered to be in good health with favourable indications in terms of the social determinants of health factors such as economic wellbeing, educational attainment and access to preventive and acute care services.

As indicated in the MAML report, internationally-accepted guidelines for community exposure to SO_2 were exceeded in measurements taken in James Bay during the summer of 2009. Analyses of the MAML measurements and data from the MOE air quality monitoring station on Topaz Avenue from 2006 to 2009 associated these levels of SO_2, which exceed international SO_2 guidelines, with cruise ship activity on Victoria's waterfront.

As noted in the MAML report, no British Columbia air quality guidelines for SO_2 (or nitrogen dioxide [NO_2] or particulate matter [PM]) were exceeded during the study. Based on the assessment performed by BCCDC**,** I have chosen to structure my review and response on guidelines established by the World Health Organization (WHO), originally published in 1987 and designed to reduce the health impacts of air pollution from particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2). These guidelines were updated in 1997 and then again in 2005 and reflect expert evaluation of scientific evidence of health effects of exposure to these air pollutants. In the case of SO_2, guidelines for very short term exposures (10 minute averages) were established for the first time in 2005. Experimental studies demonstrated that exercising asthmatics could experience clinical symptoms after exposures as short as 10 minutes. Also in 2005, the guideline for medium term exposures (24 hour averages) was decreased from 125 micrograms per cubic meter to 20 micrograms per cubic meter, also as a result of new scientific evidence. Current Canadian and BC guidelines have not yet been revised and are not as stringent as the WHO guidelines. For the purpose of my public health assessment of the James Bay data, the WHO guidelines are referenced because they represent the most up to date science.

Findings:

- The 2009 emission concentrations measured at the MAML location do not lend themselves to a conclusion that there would be related long term health effects for James Bay residents. The levels of SO_2, which exceeded guidelines from time to time in James

Bay, are episodic, localized and seasonal and are dependent on meteorological conditions on any given day.

- However, short term health effects could occur in not only those expected to be susceptible but also individuals not normally considered being at risk. Measures of SO_2 averaged over 10 minutes and SO_2 measurements recorded over 24 hour intervals are of potential concern to the health of some James Bay residents. For example, SO_2 exposure, especially at the higher levels recorded during the 10 minute intervals could plausibly cause wheezing and difficulty breathing in persons with asthma, and to a lesser degree, mild breathing problems in persons who do not have respiratory disease. These reactions are made more likely to occur during exercise, when deep breathing allows SO_2 to reach deeply into the lungs. Under these circumstances, not actively exercising would be protective. As well individuals with underlying chronic illness should be optimally managing their chronic conditions up to and including anticipatory prophylaxis.

- Staying indoors may reduce the effective exposure to peak levels on SO_2. SO_2 is a reactive gas, and reacts with people and building contents, thereby reducing its concentration in confined spaces such as in a house or apartment. Air conditioning may lower indoor concentrations further by lowering the rate of air exchange from outdoors to indoors.

- Based on the epidemiologic research that informed the international guidelines for 24-hour SO_2 exposure, cruise ship-derived SO_2 could be expected to have a very small, but calculable impact on the risk of increased excess mortality on the days ships are in port. For the population a population the size of James Bay, in the opinion of Dr. Tom Kosatsky of BCCDC derived from his assessment of the existing limited scientific literature on the subject, there would be in the range of 0.4 to 1.6 excess deaths in a given cruise ship season. However, this estimate **does not** take into account the favourable demographics of the James Bay neighbourhood nor does it reflect the overarching dampening effect proper management of chronic illness would have on such a calculation. The actual risk consequently is substantively less but cannot be derived with scientific certainty. In the epidemiological literature, mortality events tend to serve as collective markers for other less severe, but more numerous health impacts. SO_2 is not the only pollutant than can cause problems with breathing in the population and influence this mortality metric.

- Health conditions which might be exacerbated by exposures to SO_2 are asthma and Chronic Obstructive Pulmonary Disease (COPD). These conditions are generally self-managed in the population under supervision of medical professionals and if well con-

trolled, do not require sudden or unanticipated health service intervention. An individual experiencing a health impact from an excessive exposure to SO_2 should still be able to avoid having to need the involvement of physicians' offices, emergency rooms or in-patient wards. Further, it is critical that self-management is optimally practiced by individuals with the aforementioned conditions for there are many other air-borne agents that could trigger an exacerbation of their illness, for example the three indicators of poor air quality that make up the federal Air Quality Health Index (ozone, NO_2 and PM2.5).

Recommendations

As the 10 minute average and the 24 hour average WHO sulphur dioxide exposure guidelines can be on occasion be exceeded by cruise ships entering, berthing and departing Victoria Harbour, and as this could potentially affect the health and quality of life of some James Bay neighbourhood residents, I recommend the following:

1) Individuals with chronic lung or heart disease who live in the vicinity should be encouraged to work with their physician to continue to optimally self-manage their condition, as this would be an essential measure to ameliorate any potential short-term SO_2 health effects.

2) Voluntary mitigation measures should be considered for the next few cruise ship seasons until recently-adopted International Maritime Organization (IMO) regulations come into effect in August of 2012. SO_2 from cruise ships will be reduced through the use of fuel containing the equivalent of 1% sulfur.

3) These mitigation measures could be realized through:

    - Voluntary use of lower sulfur fuel (1%) by cruise ships while approaching, berthing and departing Victoria Harbor with or without monetary incentives from Transport Canada or the Victoria Harbor Authority;

    - Adoption of lease language by the Victoria Harbor Authority to require the above low sulfur fuel use during these activities;

    - Remind members of the public in susceptible population groups to familiarize themselves of times when increased levels of SO_2 may be present and take the appropriate countermeasures.

4) Continue monitoring of cruise ship emissions at Ogden Point – to be done by the appropriate agency.

5) Implement systemic and specific monitoring of chronic disease prevalence and management among James Bay residents to track any possible associated burden of disease among residents in this neighbourhood. VIHA will continue to work with Emergency Departments and the Coroner's Service to identify any changes in previously observed patterns of chronic disease exacerbation in the James Bay resident population.

Conclusion:

Cruise ship traffic has increased in Victoria in recent years. Coupled with commercial and pleasure boat traffic as well as air traffic, Victoria's harbour is a busy place, particularly during the summer months.

Air quality monitoring surveys, underway in the James Bay community during the summer months since 2006, and the 2009 MAML report in particular, show emission levels for SO_2 from time to time exceed international guidelines. And while these levels may have a short term negative health impact on some individuals, particularly those with chronic respiratory conditions, it should be noted that negative health associations even among this vulnerable population are likely to be mitigated through appropriate management of the disease and by practicing precautions during times when emissions might be in excess of recommended levels (that is when there are cruise ships in port and meteorological conditions are such that emissions are present in the neighbourhood). There is limited evidence from Emergency Department visits or Coroner's information to suggest increased rates of death among residents in this neighbourhood. Having said that, there is a statistical possibility, in a worst case scenario and where a disease was not properly managed, that excess death could occur over the course of a year.

Air quality is of importance to the population, and overall Victoria residents enjoy excellent air quality. Concerns about air pollution in Victoria's port specifically have been raised by the James Bay Neighbourhood Association and I concur that there are occasions where SO_2 are elevated so as to cause health impacts that could affect the quality of life and well being of some area residents.

For this reason, I ask the cruise ship industry and associated agencies not wait until the new IMO regulations come into effect in 2012 to reduce SO_2 emission levels.

Respectfully submitted,

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