Korea
National Oil Corporation

Appendix J4

Health Canada's SUM15 Approach

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J4-1.0 INTRODUCTION

Potential health risks were not predicted in the HHRA for $PM_{2.5}$ based on comparison of the predicted 24-hour 98th percentile and annual average $PM_{2.5}$ concentrations against the Canada-Wide Standard (CWS) of 30 µg/m³ (CCME 2000) and the California Air Resources Board (CARB) standard of 12 µg/m³ (CARB 2002), respectfully. In addition to comparing the predicted $PM_{2.5}$ air concentrations to these recognized standards, Alberta Health and Wellness (AHW) routinely requests an evaluation of the particulate matter (PM)-attributable health impacts based on Health Canada's SUM15 method (Health Canada 1999).

Health Canada's SUM15 method was used to evaluate the potential health risks for Janvier IR 194 (R19) alone, as it was the only location within the health regional study area (RSA) for which 24-hour $PM_{2.5}$ concentrations were predicted to exceed 15 µg/m³ on one or more days during a year.

Government organizations (US EPA 2005; WHO 2005) and academic researchers (Samet 2000; Cohen 2004) have investigated and determined the excess risk of mortality and morbidity effects from exposure to daily or short-term changes in ambient PM concentrations. For example, the World Health Organization (WHO) estimates that health risks increase 0.5% for every 10 µg/m³ increase in daily $PM_{2.5}$ concentrations above 25 µg/m³ (WHO 2005). However, Health Canada's SUM15 method is used to estimate "excess health risk" by summing daily $PM_{2.5}$ air concentrations that exceed 15 µg/m³ (Health Canada 1999).

This appendix provides the assessment of health risks based on the SUM15 method as requested by AHW.

J4-1.1 Description of Data Used in the SUM15 Assessment

$PM_{2.5}$ air concentrations, including both primary and secondary particles, were predicted at Janvier by the air quality team (see Volume 4, Section 4.0). $PM_{2.5}$ air concentrations were predicted on an hourly basis for 8 760 hours per year for five consecutive years, using meteorological data from 2002 to 2006. The average daily $PM_{2.5}$ air concentrations were calculated. SUM15 calculations were completed for the planned development case (PDC) only as there were no exceedances in the Baseline Case or Application Case. Therefore, the SUM15 for Baseline Case and Application Case is zero.

J4-1.2 SUM15 Assessment

Potential health risks were calculated using SUM15 methods as described in Health Canada's Addendum to the Science Assessment Document for Particulate Matter (i.e., Health Canada SUM15 method; Health Canada 1999) in combination with predicted $PM_{2.5}$ concentrations.

Potential health risks were estimated for mortality, respiratory hospital admissions (RHA), and cardiac hospital admissions (CHA) based on the calculated cumulative concentration above 15 µg/m³ or SUM15.

The type of information that is required to calculate the mortality and morbidity risks includes:

- cumulative air concentrations of $PM_{2.5}$ or SUM15: the one-year sum (i.e., 365 days) of 24-hour $PM_{2.5}$ concentrations that exceed the Health Canada reference level of 15 µg/m³ (i.e., ∑(24-hour $PM_{2.5}$ air concentration – 15 µg/m³));
- relative risk estimates for mortality, RHA and CHA; and
- baseline mortality, RHA and CHA incidence rates.

Table J4-1 provides the estimated annual cumulative $PM_{2.5}$ air concentrations presented for the Janvier receptor location in the Baseline Case, Application Case, and PDC. Baseline Case and Application Case SUM15 were predicted to be zero.

Table J4-1 Predicted Annual Cumulative $PM_{2.5}$ Air Concentrations (µg/m³) (SUM 15) Exceeding Health Canada Reference Level of 15 µg/m³

Receptor Location	Baseline Case	Application Case	Planned Development Case
Janvier IR 194	0	0	2.2

Health Canada's baseline incidence rates for mortality, CHA, and RHA are presented in Table J4-2.

Table J4-2 Baseline Incidence Rates and Relative Risk Estimates

Health endpoint	Incidence rate per 1,000,000 population per day	Relative risk per 1 µg/m³ change in $PM_{2.5}$	
		Point estimate	95% confidence interval
Mortality	18.4	1.00140	1.00100 to 1.00180
RHA	16.0	1.00074	1.00049 to 1.00099
CHA	14.4	1.00070	1.00036 to 1.00100
Source: Health Canada 1999.			

Health Canada uses this information to calculate potential health risks related to mortality, RHA, and CHA that could be attributable to $PM_{2.5}$ as follows:

$$\text{Cumulative } PM_{2.5} \text{ Concentration} \times \text{Incidence Rate} \times (\text{Relative Risk} - 1)$$

Potential health risks were estimated for each health endpoint. For example, the predicted change in the daily mortality rate for Janvier in the PDC that would be attributable to $PM_{2.5}$ is calculated as follows:

$$\text{Change in mortality rate} = 2.2 \times 18.4 \text{ per } 1{,}000{,}000 \times (1.00141 - 1)$$
$$= 0.057 \text{ per } 1{,}000{,}000$$

This calculation illustrates that the cumulative $PM_{2.5}$ concentration of 2.2 µg/m³ predicted for the PDC at Janvier could be associated with a predicted increase in the non-accident mortality rate of 0.057 per 1,000,000 (i.e., from 18.4 to 18.5 per 1,000,000). The calculated results for Janvier for mortality, RHA, and CHA are summarized in Table J4-3, Table J4-4, and Table J4-5, respectively. The risk estimates are presented in terms of 'health effects per 1,000,000 people.

Table J4-3 Mortality (per 1,000,000 people) Attributed to Changes in Daily $PM_{2.5}$

Receptor Location	Baseline Case	Application Case	Planned Development Case
Janvier IR 194	0	0	0.057

Table J4-4 Respiratory Hospital Admissions (per 1,000,000 people) Attributed to Changes in Daily $PM_{2.5}$

Receptor Location	Baseline Case	Application Case	Planned Development Case
Janvier IR 194	0	0	0.026

Table J4-5 Cardiac Hospital Admissions (per 1,000,000 people) Attributed to Changes in Daily $PM_{2.5}$

Receptor Location	Baseline Case	Application Case	Planned Development Case
Janvier IR 194	0	0	0.022

The results indicate that the incremental changes observed are negligible as the mortality rate, the respiratory hospital admissions rate, and the cardiac hospital admissions rate do not change the baseline incidence rate (i.e., risk estimates are all less than one).

J4-2.0 CONCLUSIONS

The SUM15 assessment indicates that the predicted incremental increases in mortality and morbidity due to the project are negligible. In addition, 24-hour 98th percentile and annual average $PM_{2.5}$ concentrations were not predicted to exceed the CWS (CCME 2000) or the CARB (2002) standard, respectfully. From this, it is concluded that the project $PM_{2.5}$ emissions will have a negligible effect on mortality and morbidity rates in the health study area.

J4-3.0 REFERENCES

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WHO (World Health Organization). 2005. WHO Air Quality Guidelines Global Update 2005. Report on a Working Group meeting, Bonn, Germany, 18-20 October 2005. Copenhagen, Denmark: World Health Organization. EUR/05/5046029.