BRITISH COLUMBIA STANDARDS FOR MANAGING CONTAMINATION AT THE PACIFIC PLACE SITE

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1.0 Introduction

This document presents Ministry of Environment standards and policies that have been established to manage contamination at the Pacific Place site. They are based on, and are a subset of criteria for contaminated sites described in the document "Criteria for Managing Contaminated Sites in British Columbia".

After a careful review of standards for contaminated sites, the Ministry has chosen those that are the most comprehensive now available in Canada. The standards apply mainly to contaminated soils and groundwater, and were derived from criteria from the Canadian Council of Resource and Environment Ministers, the Province of Quebec, the Ontario Ministry of the Environment, Canadian guidelines for drinking water quality, and the Province's Special Waste Regulation and Pollution Control Objectives under the Waste Management Act. The Ministry has also consulted with public health and environmental experts in establishing these standards. While these standards are intended to prevail throughout the remediation period for the Pacific Place site, they may be adjusted as new human health and environmental information becomes available.

2. 0 Standards for Contaminants

2. 1 Information Requirements

In determining standards for addressing contamination at a specific site, the types and levels of contaminants, the particular environmental media that are contaminated and the intended land use must be known. At the Pacific Place site, a thorough investigation of the types and concentrations of contaminants has been completed, and the media impacted, the exposure pathways, and the potential receptors have been identified. The property is intended for mixed residential, commercial, park, and recreational use.

2. 2 Types and Application of Standards

The Ministry has developed two types of standards for managing contaminated sites in British Columbia. The first type involves numerical contaminant concentration standards which can be used to determine

when detailed investigation, and/or site remediation is needed, and when site remediation is properly completed. The second type involves site specific risk assessment and risk management, where potential human health risks posed by contaminants are derived and. are compared to numerical standards corresponding to levels of risk that are considered publicly acceptable.

The contaminant concentration approach is applicable to situations where contaminants can be removed to levels less than the applicable numerical remediation standards, and it addresses both human health and environmental impacts.

The risk assessment approach may be used in situations where there are potential human health impacts, and exposure to contaminants is reduced to acceptable levels by either containment or contaminant removal. In contrast to the contaminant concentration approach, it can be applied where all contaminants cannot be removed due, for example, to physical or financial constraints. In its present form, risk assessment has been sufficiently developed so that it can only be used to address public health issues associated with contaminated sites. Thus, if risk assessment is used to manage a contaminated site, the contaminant concentration approach is also required to address potential environmental effects.

2. 3 Standards for Soils

2. 3. 1 Contaminant Concentration Approach

Table 1 contains a list of numerical investigation and remediation standards for contaminants that may be contained in soils on this site. Investigation standards are contaminant concentrations which when exceeded require detailed investigation to assess the extent of contamination and nature of any hazards. Remediation standards are contaminant concentrations which when exceeded require action to reduce exposure of humans or other receptors to contaminants. This action could include cleanup, containment, creation of barriers, change in land use, or other form of mitigation.

<u>Investigation and Remediation Standards</u>

Table 1 contains three soil levels, A, B and C, which are used as investigation and remediation standards as explained below:

Level A: This level represents approximate achievable analytical detection limits for organic compounds in soil, and natural background levels of metals and inorganics. For soils with constituents at or less than this level, the soils are considered uncontaminated. For residential land use level A is the investigation standard.

For soils containing contaminants at concentrations greater than level A, but less than level B, the soil is considered slightly contaminated, but remediation is not required.

Level B: This level is an intermediate value, approximately 5 to 10 times above level A. For residential and recreational land use this level is the remediation standard, while for exclusive commercial or industrial land use it is the investigation standard.

For soils containing contaminants with concentrations exceeding level B, but less than level C, the soil is considered contaminated, and requires remediation to levels less than level B, if the land is used for residential or recreational purposes. Remediation will not be required if the land is used exclusively for commercial or industrial activities.

Level C: At this level, contamination of soil is significant. For exclusive commercial or industrial land use, level C is the remediation standard. For soils containing contaminants exceeding this level, all uses of the land will be restricted pending the application of appropriate remedial measures, which will reduce contaminant concentrations to levels less than level C.

Restoration of PCB Contamination

In the case of soils contaminated with PCBs, the contamination will always be remedied by cleanup to concentrations less than level B or level C in Table 1, as is required for the land use identified.

2. 3. 2 Risk Assessment and Risk Management Approach

Where the risk assessment and risk management approach is chosen, exposures to contaminants on the site must be reduced so that the maximum acceptable additional lifetime cancer risk to residents for carcinogenic contaminants will not exceed seven in one million and one in one million should be sought. The seven in one million lifetime cancer risk is the same as that used by Health and Welfare Canada to protect the public from any unacceptable risk related to the intake of radioactive, contaminated drinking water. The one in one million risk level is commonly regarded as a "de minimus" risk level, below which agencies normally do not take regulatory action to control the risks. For noncarcinogenic substances, exposures must be reduced so that the predicted chronic daily intake of contaminants under residential land use, will be less than the chronic acceptable daily intake established by the Ministry.

2. 4 Standards for Groundwater

Contaminants in groundwater at the Pacific Place site can impact on humans or the environment. Since the groundwater will not be used for human consumption, the protection of False Creek aquatic resources is a priority. Under Ministry policy, discharges to receiving waters which are acutely toxic are not allowed, and this policy will apply to groundwater at the Pacific Place site.

Investigation and de minimus standards for groundwater contaminants are also shown in Table 1 and are explained below:

Level A: Level A represents the approximate achievable analytical detection limits or natural background levels of metals and inorganic and organic compounds. For water with constituents at or less than this concentration, the water is considered uncontaminated. Level A for water is the investigation standard.

For water containing contaminants at concentrations greater than level A, but less than level B, the water is considered slightly contaminated, and detailed investigation is necessary, but remediation is not required.

Level B: Level B is the de minimus standard for water. For water containing constituents with concentrations less than level B, no remediation will be required. Contaminant concentrations exceeding level B require further work to assess the relative impact of these substances and to determine appropriate action.

When a standard for a non-carcinogenic substance is not contained in Table 1, then the 96 hour LC50 concentration for the most sensitive salmonid species will be used as the standard, with an additional safety factor of 5 applied for persistent and/or bioaccumulative substances.

2. 5 Standards for Air

It is not anticipated that air quality standards will be needed for contaminants at the Pacific Place site. The paper " Criteria for Managing Contaminated Sites in British Columbia' describes how air standards will be established, if it becomes necessary.

2. 6 Background Levels of Contaminants

In the event that natural Lower Mainland background levels of contaminants found at the Pacific Place project exceed the standards described in sections 2.3 through 2.5, the standards will be set at background levels. False Creek water shall not be used as a reference for background levels.

3. 0 Special Waste Standards

Where special waste contaminants from the Pacific Place Project are handled or treated on site, the Special Waste Regulations under the Provincial Waste Management Act will apply to the facilities in which the waste is managed.

4. 0 Development of Standards Not Described Previously

Table 1 contains standards for approximately 100 potential soil contaminants. While these may be expected to be sufficient to address contamination at most Pacific Place parcels, it is possible that other contaminants may be discovered for which standards will have to be developed. The paper "Criteria for Managing Contaminated Sites in British Columbia" describes how this will be done should it become necessary.

5. 0 Choice of Hazard Indicator Compounds

The hazard indicator compounds used for the Pacific Place project will be those for which numerical standards appear in Table 1. Where other hazard indicator compounds are required, they will be established by the Ministry in consultation with other government agencies.

TABLE 1: INVESTIGATION AND REMEDIATION STANDARDS FOR PACIFIC PLACE SOIL AND GROUNDWATER

		Soil mg/kg (ppm) of dry matter			Groundwater µg/L (ppb) of water	
		A	B	C	A	B[9]
1. HEAVY METALS						
arsenic	(As)	5	30	50	10	50
barium	(Ba)	500	1000	2000	50	1000
cadmium	(Cd)	1.0	5	20	1	5
chromium	(Cr)	20	250	800	10	50
cobalt	(Co)	15	50	300	10	50
copper	(Cu)	30	100	500	10	100
lead	(Pb)	50	500	1000	10	50
mercury	(Hg)	0.1	2	10	0.1	1.0
molybdenum	(Mo)	4	10	40	10	500
nickel	(Ni)	20	100	500	50	500
selenium	(Se)	2	3	10	1	10
silver	(Ag)	2	20	40	1	50
tin	(Sn)	5	50	300	1	500
zinc	(Zn)	80	500	1500	10	200
2. OTHER INORGANICS						
bromide (free)	(Br)	20	50	300		
cyanide (free)	(CN free)	1	10	100		
cyanide (total)	(CN total)	5	50	500	5	100
fluoride (free)	(F free)	200	400	2000		
sulfur (total)	(S total)	500	1000	2000		
3. MONOCYCLIC AROMATIC HYDROCARBONS (MAHs)						
benzene[8]		0.1	0.5	5	0.5	0.5
ethylbenzene		0.1	5	50		
toluene		0.1	3	30		
chlorobenzene		0.1	1	10		
1,2-dichlorobenzene		0.1	1	10		
1,3-dichlorobenzene		0.1	1	10		
1,4-dichlorobenzene		0.1	1	10		
xylene		0.1	5	50		
styrene		0.1	5	50		
4. PHENOLIC COMPOUNDS						
nonchlorinated phenols (each)[1]		0.1	1	10		
chlorophenols (each)[2]		0.1	0.5	5		
chlorophenols (total)		0.1	1.0	10		

	Soil mg/kg (ppm) of dry matter			Groundwater µg/L (ppb) of water	
	A	B	C	A	B[9]
5. POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)					
benzo[a]anthracene[3,8]	0.1	1	10	0.01	0.01
1,2-benzanthracene 7,2-dimethyl	0.1	1	10		
dibenzo[a,h]anthracene[3,8]	0.1	1	10	0.01	0.01
chrysene	0.1	1	10		
3-methylcholanthrene	0.1	1	10		
benzo[b]fluoranthene[3,8]	0.1	1	10	0.01	0.01
benzo[j]fluoranthene	0.1	1	10		
benzo[k]fluoranthene[3,8]	0.1	1	10	0.01	0.01
benzo[g,h,i]perylene	0.1	1	10		
benzo[c]phenanthrene	0.1	1	10		
pyrene[3]	0.1	10	100		
benzo[a]pyrene[3,8]	0.1	1	10	0.01	0.01
dibenzo[a,h]pyrene	0.1	1	10		
dibenzo[a,i]pyrene	0.1	1	10		
dibenzo[a,l]pyrene	0.1	1	10		
indeno[1,2,3-cd]pyrene[3,8]	0.1	1	10	0.01	0.01
acenaphtene	0.1	10	100		
acenaphtylene	0.1	10	100		
anthracene	0.1	10	100		
fluoranthene	0.1	10	100		
fluorene	0.1	10	100		
naphthalene[3]	0.1	5	50		
phenanthrene[3]	0.1	5	50		
PAHs (total)	1	20	200		
6. CHLORINATED HYDROCARBONS					
aliphatic					
(each)[4]	0.3	5	50		
(total)[4]	0.3	7	70		
chlorobenzene[5]					
(each)	0.1	2	10		
(total)	0.1	4	20		
hexachlorobenzene	0.1	2	10		
polychlorinated biphenyls[6]	0.1	5	50	0.4	3
7. PESTICIDES					
pesticides (total)	0.1	2	20		
8. GROSS PARAMETERS[7]					
mineral oil and grease	100	1000	5000		
light aliphatic hydrocarbons	100	150	800		

FOOTNOTES

1. Non-chlorinated phenolic compounds, which include:

   2,4-dimethylphenol
   2,4-dinitrophenol
   2-methyl-4,6-dinitrophenol
   2-nitrophenol
   4-nitrophenol
   phenol
   cresol (ortho, meta, and para)

2. Chlorophenols, which include:

   orthochlorophenol
   metachlorophenol
   parachlorophenol
   2,6-dichlorophenol
   2,5-dichlorophenol
   2,4-dichlorophenol
   3,5-dichlorophenol
   2,3-dichlorophenol
   2,4-dichlorophenol
   2,4,6-trichlorophenol
   2,3,6-trichlorophenol
   2,4,5-trichlorophenol
   2,3,5-trichlorophenol
   2,3,4-trichlorophenol
   3,4,5-trichlorophenol
   2,3,5,6-tetrachlorophenol
   2,3,4,5-tetrachlorophenol
   2,3,4,6-tetrachlorophenol
   pentachlorophenol

3. If a site is contaminated with coal tars, these are the standards that apply.

4. Volatile chlorinated aliphatic hydrocarbons, which include:

   chloroform
   1,1-dichloroethane
   1,2-dichloroethane
   1,1-dichloroethene
   1,2-dichloroethene
   dichloromethane
   1,2-dichloropropane
   1,2-dichloropropene (cis and trans)
   1,1,2,2-tetrachloroethane
   tetrachloroethene
   carbon tetrachloride
   1,1,1-trichloroethane
   1,1,2-trichloroethane
   trichloroethene

5. Chlorobenzenes, which include:

   trichlorobenzenes (all isomers)
   tetrachlorobenzenes (all isomers)
   pentachlorobenzene

6. Polychlorinated biphenyls, which include:

   Arochlors 1242, 1248, 1254 and 1260

7. To be used as investigation standards only.

8. Organic compounds regarded as carcinogens.

9. To be used as de minimus standards only.