

# **Toward a Contaminated Sites Assessment Process for British Columbia**

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## 1.0 INTRODUCTION

The environmental and human health risks posed by contaminated sites leapt to the forefront of public consciousness in British Columbia (BC) with the discovery of severely contaminated soil and water on the proposed Pacific Place development site, located on the former EXPO'86 lands, adjacent to False Creek in Vancouver. The problems exposed by the EXPO lands are symptomatic of a general class of environmental contamination that has, until recently, been ignored in British Columbia.

## 2.0 ISSUES STATEMENT

The purpose of this research is to evaluate comparatively environmental assessment processes used to review contaminated sites in various jurisdictions with British Columbia. The assessment processes to be evaluated are:

- *Guidelines for the Decommissioning of Sites in Ontario (1990)*;
- *Quebec's Contaminated Sites Rehabilitation Policy (1988)*;
- Toronto's draft policy (1991);
- United States, Environmental Protection Agency's *Superfund* program (1980);
- Oregon's *Environmental Cleanup Program (1990)*; and
- British Columbia's *Soils Remediation Program (1989)* is also reviewed.

The results of the evaluation are synthesized into recommendations for a contaminated sites assessment process for British Columbia.

## 3.0 METHODOLOGY

The assessment processes mentioned above were evaluated in terms of the criteria listed and defined below. These are adapted from Canada, Environment Canada (1986).

1. *Mandate* - the legal authority for a particular process;
2. *Scope* - the stated objectives of the process;
3. *Coverage* - the types of sites that apply the assessment process applies to;
4. *Administration* - the agency responsible for overseeing the assessment process;
5. *Procedure* - the formal, administrative procedure that is followed during a given site assessment;
6. *Proponent's role* - the tasks required of an individual developer or landowner;

7. *Municipal authority roles* - the land use planning and development functions, pertaining to contaminated sites, undertaken by local governments;
8. *Public's role* - the opportunities for members of the public, vested interest groups, or nongovernmental organizations to participate in decision making;
9. *Standards* - all applicable assessment and remediation criteria, guidelines, objectives and legal, encoded standards;
10. *Documentation* - the types and public availability of information pertaining to site investigation and remediation;
11. *Compliance and verification* - the administrative or legal controls in place to ensure conformance with agency requirements;
12. *Enforcement* - criminal and civil penalties provided for by statute, if applicable;
13. *Funding* - sources of funding for the assessment process; and
14. *Decision making authority* - the individual or agency that has the final authority in determining whether a site, after assessment and remediation, meets cleanup standards.

#### 4.0 COMPARATIVE ANALYSIS

In this section, a comparative analysis of the strengths and weaknesses of various assessment processes is presented.

##### 4.1 Mandate, Scope and Coverage

*Mandate.* It is important that an assessment process aimed at contaminated sites review be legislatively based. Indeed, all assessment processes evaluated, treat contaminated sites as a waste management problem, including British Columbia's *Pacific Place Soils Remediation Program*. Hence, other the City of Toronto, all processes are promulgated under waste management legislation. Pertinent legislation is summarized in table 1 below:

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**Table 1. Legislation Pertaining to Contaminated Sites Assessment**

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British Columbia	<i>Waste Management Act</i>
Ontario	<i>Environmental Protection Act</i>
Quebec	<i>Environment Quality Act</i>
Toronto	<i>Planning Act</i>
United States	<i>Comprehensive Environmental Response, Compensation and Liability Act</i>
Oregon	<i>Environment Quality Act.</i>

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*Scope.* The stated objectives, or scope, of the assessment processes evaluated were diverse. Some have much broader objectives than others. For example, Ontario's objective to ensure environmentally and socially acceptable plant decommissionings. Quebec's process has a narrow focus, aimed at land developers in urban areas. Conversely, *Superfund* and Oregon's *Environment Cleanup Program* have broader objectives, which are: to provide long-term solutions to existing toxic waste sites. This may include nonurban-based land uses, such as mineral and forest resource extraction.

In comparison, BC Environment's objective for Pacific Place is to render the site suitable for redevelopment. However, it may be more appropriate to adopt and modify Ontario's policy objectives in British Columbia, which is, to ensure socially and environmentally acceptable plant decommissionings and site cleanups. This is more in line with the concept of sustainable development, which ensures that decisions affecting the environment are made that incorporate the following: social values, continued economic growth, and that maintains "natural capital" or ecosystem viability (WCED 1987).

*Coverage.* Each jurisdiction reviewed targeted a different array of interest groups in their respective assessment processes. For example, Ontario's process covers a wide range of activities. It regulates all private-sector and some public-sector actors, including municipalities, who may be involved in a planned facility decommissioning. Some waste-management facilities and resource-extraction industries are exempted, as they are regulated elsewhere. Quebec's process concentrates on urban redevelopment. Hence, its

policy is oriented mainly toward landowners and developers in urban areas. Toronto's draft policy is aimed at redevelopment of contaminated sites that may pose a risk to human health, in keeping with its municipal-level priority of protecting human health. The United States' *Superfund* program and Oregon's ***Environmental Cleanup Program*** target all types of activities and interest groups. These latter programs are aimed at minimizing risk posed to human health and the environment, regardless of the type or source of contamination involved.

British Columbia's assessment process, exemplified by the Pacific Place program, is based on an informal, government-proponent agreement. In order that an assessment is more effective, a process should be implemented that reflects the province's natural resource-based economy, as well as changing societal values of the 1990s. Respecting abandoned, or "orphan" sites, a formally instituted process should incorporate a risk-management approach for prioritizing sites slated for cleanup within the province. Such a procedure would tend to optimize the use of public financial resources. Further, the process should include nonurban land uses. Thus, an assessment process focusing on development in the urban environment is likely to fall short of its ultimate objective.

#### 4.2 Administration and Procedure

***Administration.*** This section considers the institutional arrangements established to manage contaminated sites. Of the systems evaluated, there were subagencies created or appointed that were designated as lead agencies for the development and implementation of each process. With the exception of British Columbia, these lead agencies are charged with the administration of a specific assessment process for reviewing sites degraded by land contamination. The agencies involved are summarized below in table 2:



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**Table 2. Agencies Responsible for Assessment of Contaminated Sites**


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British Columbia	Ministry of Environment, Lands and Parks - BC Environment
Ontario	Ministry of the Environment - Waste Management Branch
Quebec	<b>Minister-e de l'environnement</b>
Toronto	Public Health Department - Environmental Protection Office
United States	Environmental Protection Agency - Office of Emergency and Remedial Response
Oregon	Department of Environmental Quality - Environmental Quality Commission.

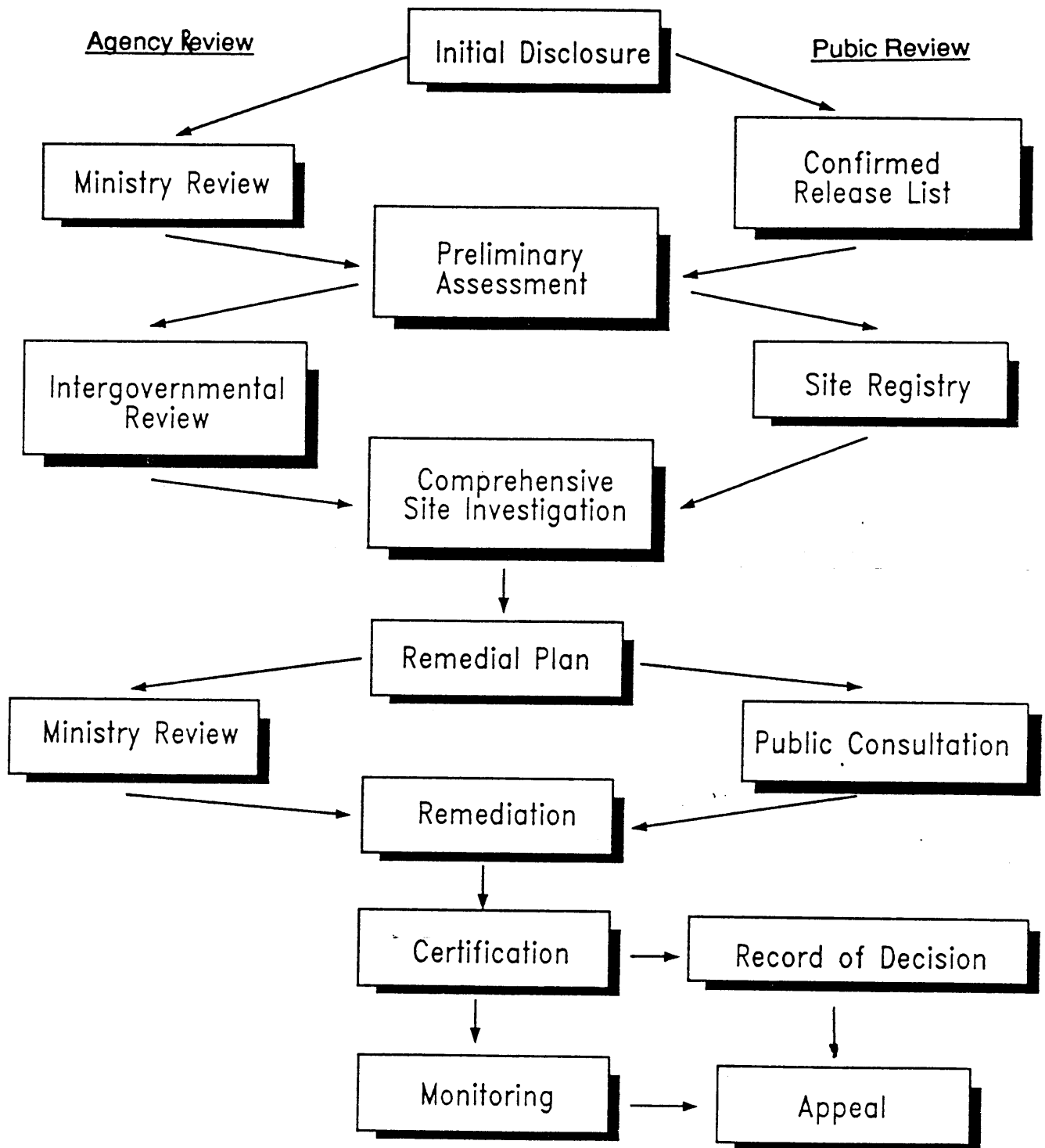
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It has been suggested in the literature that an independent board be commissioned to oversee the decision making process (Russell and Andrews 1990).

**Procedure.** Each jurisdiction's approval process is characterized by a number of basic steps in a phased approach. These steps are categorized generally as: disclosure; initial assessment; detailed characterization; remedial planning; treatment; site closure; post-treatment monitoring or assessment; municipal-level, land use approval; and disposal of treatment residues. The purpose of the procedure is to ensure that land is managed in a sustainable manner. Agency review, municipal approval, and public consultation should be well-integrated into a new review process.

The key step in the process is the initial reporting of contamination. This is essential for an assessment process to be effective. For example, if contamination can be flagged prior to a real estate transaction, an application for a development permit or rezoning approval, or approval for a plant decommissioning or closure of an industrial facility, then the policy would be reasonably effective. However, if disclosure of potential contamination to BC Environment is not required, legally or administratively, then the effectiveness of the rest of the approval process is compromised. Currently, in British Columbia, reporting of contamination from past industrial activity is not mandatory, although many site owners voluntarily disclose degradation of their sites. In these situations, BC Environment's opinion is necessary to expedite a property title transfer, as required by financial institutions. It is recommended that the reporting of any significant instance of contamination to BC Environment be mandatory, under the *Waste*

Figure 1. Proposed Contaminated Sites Assessment Process for British Columbia.



*Management Act.*

A proposed contaminated sites assessment process, shown in figure 1, is recommended for adoption by the province. This approval process would be well documented in written guidelines.

### **4.3 Stakeholder Roles**

Three major stakeholders that may possibly be impacted by a contaminated site in the jurisdictions evaluated. These include: the proponent, who is either the site owner or developer; local authorities; and the public.

***Proponent's Role.*** A landowner or developer is generally responsible for ensuring that a site meets with the requirements of the assessment, that is, the "polluter pays". In Ontario and Quebec, where conveyancing laws do not prevent the transfer of liability when land title is transferred, it is up to a prospective buyer to ensure that no residual contamination remains. What is required is a fair administrative procedure for identifying the responsible party, through a set of firmly established liability rules, as was established in the United States (Russell and Andrews 1990). Ontario recognizes joint and several liability, whereas in the United States, the liability net is wider encompassing strict, joint and several, and retroactive liability of any party with a past connection to a site. By comparison, British Columbia relies strictly on the common law remedy of "buyer beware", rather than the "polluter pays" principle. Thus, the legal system in British Columbia discriminates against all but current property owners. Additionally, the conflict between disclosure of contaminated private property and a landowner's social responsibility appears to be a major stumbling block in the implementation of an effective assessment process. Hence, it is recommended that clear and consistent liability rules be established by the province, in connection with the adoption of an assessment process.

***Municipal Role.*** There is a need to clarify municipal responsibilities for contaminated sites (Russell and Andrews 1990). In Canada, local governments are required to protect public health and oversee municipal planning and development efforts. These responsibilities necessitate that a local government be involved in an assessment. Conversely, in the United States, local governments have no recognized role in a site review. Their involvement is limited to the judicial system where environmental damages

are assessed and mitigative actions ordered.

In British Columbia, with the exception of the City of Vancouver, who is currently reviewing its priorities and responsibilities, municipalities have, as yet, not articulated their land use assessment requirements respecting redevelopment of former industrial property. It is recommended that all municipalities in British Columbia establish their position on contaminated land use in a written land use policy or bylaw, along with full participation in the review process itself.

**Public Role.** Not all jurisdictions evaluated in this study acknowledge the general public as a legitimate stakeholder in site assessment. Ontario, the United States, and Oregon require mandatory public consultation, which comes into effect when contamination is first reported to a responsible agency. In comparison, Quebec's public consultation process is more limited to public notice through the print media. But in general, most jurisdictions require a proponent to hold a public meeting and provide a reasonable time for public comment. In addition to public consultation, Oregon is the only jurisdiction that explicitly provides financial and technical support to public interest groups with a stake in contaminated sites.

Compared to other jurisdictions reviewed in this study, British Columbia does not currently require a proponent to establish a complete public participation process. For example, only limited legal notification is given when property classed as a historically contaminated special waste site, as defined in the *Special Waste Regulation*, is given approval for treatment. Nonetheless, a public meeting was convened on an ad hoc basis, regarding soil contamination at the Pacific Place development. The province has a tendency to treat community concerns as a public relations exercise to be endured. An amendment to the *Waste Management Act* that enshrines citizen participation in the decision-making process is needed.

#### **4.4 Standards**

The assessment processes evaluated have investigative and cleanup criteria, standards, and other requirements respecting contaminated sites. Some have legal standing and others do not. The most comprehensive standards exist in the United States. The United States Environmental Protection Agency and the Oregon Department of

Environmental Quality provide standards for several media including: onsite works; air quality; soil; biota; and associated ground and surface water. Other jurisdictions are deficient in the regulation of one or more of these media. American state and federal standards are legally binding; standards in Canadian jurisdictions are generally not.

In British Columbia, the recently instituted *Criteria for Managing Contaminated Sites in British Columbia* apply only to soil and water (ref). These criteria are not legally binding, although standards promulgated under the special waste criteria, outlined in schedule 6 of the *Special Waste Regulation*, are enforceable.

Other criteria or requirements for assessment and remediation considered by the jurisdictions studied are listed as follows:

- public acceptability;
- future land use;
- reduction in risk factors;
- long-term, cost-effectiveness;
- treatment implementability or "treatability";
- natural-resource recovery;
- numerical criteria, objectives, or standards;
- ambient or background conditions; and
- operational safety concerns.

Ontario is the only jurisdiction requiring public acceptance of cleanup criteria. American jurisdictions require that cost-effectiveness, treatment implementability, operational safety, and resource recovery be considered during a site review. Oregon requires that cleanup to pristine conditions be considered in an evaluation.

In British Columbia, the main criteria for approval, or "write-off", of a site are limited to its intended land use and established, numerical criteria. At Pacific Place, for example, human-health risk factors, cost-effectiveness, and treatment implementability were also considered in the site assessment. It is recommended that the extended list of criteria given above be considered in a routine evaluation.

#### **4.5 Documentation**

A social inequity occurs if information is not adequately disseminated to all stakeholders. Second, there are cost advantages, accruing to ministry, of compelling site owners to provide the public and other stakeholders with relevant information. However,

from an effectiveness perspective, it is in the interest of a responsible agency to supply information directly through site registration, as the relative cost of supplying information to the public is low (Weimer and Vining 1990).

All jurisdictions considered provide some information about soil and water quality routinely. Any other information relevant to a particular site is only available indirectly through licensing, permitting, and certification procedures. For example, Ontario and Quebec provide direct information through registration of documents pertinent to site evaluation on land title in the province. Toronto, Quebec, the United States, and Oregon all compile and maintain a list of contaminated and potentially contaminated sites, or site inventory. British Columbia has not followed suit.

An important feature of the *Superfund* program is the Environmental Protection Agency's obligation to publish a *Record of Decision* (ROD) once a site is closed. It is recommended that records of decision be documented and made available, for a nominal fee, in British Columbia.

Another problem in British Columbia, the conflict between disclosure and confidentiality, has yet to be resolved. The only exception is if a property qualifies as a "historically contaminated special waste site". In such instances, documents pertaining to the assessment and remediation of a site are available for public viewing. Regarding Pacific Place, for instance, most relevant information is readily available, and provisions were made to keep the public informed through a quarterly newsletter. It may be difficult or impractical to append large amounts of technical information to the province's existing land-title data base, although this would be the most cost-effective route from the public's perspective. It may be more cost-effective to circulate a "confirmed-release" list to government agencies and municipalities for public dissemination.

This inventory should include the type and extent of contamination within each region, broken down by municipality or regional district. This could be accomplished through the establishment and maintenance of a province-wide, computerized data base. Provincial decisions, such as funding and staff requirements, could then be made more effectively. In urban areas, this data base could be compiled in a cost-effective manner by municipal authorities who have access to archived, historical land use documents.

Hence, this responsibility could be delegated to local governments.

#### **4.6 Compliance, Verification and Enforcement**

*Compliance and verification.* There are two basic methods for ensuring compliance with agency requirements of the jurisdictions evaluated in this study. Most authorities require a proponent to obtain written certificates of compliance, or other administrative instrument, such as a letter of approval. The second method, which is used in Toronto and at Pacific Place, is to enter into a contractual agreement with a proponent. In addition to these methods, the province may also place a restrictive covenant on a particular site, which limits the future use of land.

*Enforcement.* Agency enforcement is accomplished in a variety of ways: by the issuance of a control order, or another order for remediation, or some other such administrative order. For example, Ontario may order a property owner to undertake a characterization study or a remedial action. Alternately, American jurisdictions can impose a criminal penalty for noncompliance. In Oregon, the Department of Environmental Quality may register a claim of lien on property whose owner is in noncompliance.

Currently, in British Columbia, the main enforcement provision in the *Waste Management Act* is a pollution abatement order. It was originally intended to enforce compliance on owners introducing discharges to the environment. Thus, it is recommended that orders for remediation and characterization be included in the act.

#### **4.7 Funding**

Canadian jurisdictions fund contaminated sites activities from general revenue. *Superfund* is unique as the income from this revolving trust fund originates from a "carbon", or feedstock tax, on petrochemicals and other manufactured items. Cost-recovery provisions for abandoned sites were put in place so as to make the program significantly self-financing. The problem with this feedstock tax is that the link between the regulated activity and the taxed one is weak. Alternately, a waste end tax on contaminant disposal activities would be more desirable. This provision, if adopted in British Columbia, would further encourage soil conservation. Money held in trust could be used to cleanup abandoned sites. Hence, cost-recovery provisions should be put in place so as to make administration of the process significantly self-financing.

There is a general misconception that licensing and permitting fees are instruments for financial or market incentives. But strictly speaking, they are not (Gunton and Richards 1987). However, several jurisdictions, including British Columbia, charge fees for various government services. The implementation of a user fee has several advantages, as it allows for the internalization of environmental costs, as well as price public services appropriately in the marketplace. It is recommended that a user-fee schedule for government services be developed in British Columbia, in conjunction with the assessment process adopted.

#### **4.8 Decision Making Authority**

In most jurisdictions, a single decision-making authority approves a site cleanup subsequent to a full assessment. However, there is an exception. The United States, for example, allows an affected state some authority over final treatment measures. In addition, many decisions made by regional administrators in the United States can be appealed through the judicial system. Unfortunately, this has led to a litigious atmosphere surrounding *Superfund*, and unacceptably high transaction costs, including legal fees. Alternately, when a ministerial decision is questioned in Ontario, the ministry allows its decisions to be reviewed by the ministry's Environmental Appeal Board. Implementation of a formal appeal procedure is recommended for British Columbia. For the majority of sites considered, however, decisions are made by a regional waste manager without consultation with local authorities or the public. This top-down approach to decision making should be revised to encompass municipal and public concerns.

Although decision-making in British Columbia is vested in provincial regional waste managers, the Pacific Place development in Vancouver is an exception. In this case, the province in this case is both the regulator and the proponent, making this development a public works undertaking. Therefore, authority for public expenditure is approved using a standard procedure required by the provincial treasury board and cabinet. As an alternative, it is recommended that provincial decision making respecting a site assessment be more consensus driven in future. Public and other government agency concerns should be routinely considered in a site review.



In summary, recommendations for improved regulation of contaminated sites in British Columbia are synthesized from the various jurisdictions evaluated in this study. These are summarized in table 3 below.

Table 3. Proposed Contaminated Sites Assessment Process for British Columbia.

Mandate	<i>Waste Management Act.</i>
Scope	To ensure socially and environmentally acceptable plant decommissionings and site cleanups.
Coverage	Any activity that causes, or has caused, contamination.
Administration • lead agency • activities	BC Environment, Environmental Protection Division. Information and advice, quality control, command and control, technology assessment, and abandoned site management.
Procedure	Formal review process that includes interagency review and full public participation.
Proponent role	Disclosure, initial assessment, detailed characterization, remedial planning, treatment, and monitoring.
Municipal role	Official plan development, rezoning application approval, building permit, toxic real estate policy, assessment of fuel dispensing operations.
Regional district role	Soil conservation program.
Public role	Public consultation process.
Standards • medium • legal standing • substances regulated • cleanup basis	Buildings, equipment, air, sediment, soil, ground and surface water; Cleanup standards;  Organics and inorganics; and Future land use, background contaminant levels, water quality objectives, long-term cost-effectiveness, and resource recovery.
Documentation	All relevant documentation, post-cleanup report, available at nominal fee, confirmed-release list, and site inventory.
Compliance and verification	Certificate of compliance.
Enforcement	Characterization order, remedial order, and fines.
Funding	Self-financing program through disposal fees in trust.
Decision-making authority	Environment minister, waste management director, and Environmental Appeal Board.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that BC Environment establish a comprehensive assessment process should be implemented, and accompanying guidelines for contaminated sites prepared. Assessment requirements would be entrenched in the *Waste Management Act* or associated regulations. The effectiveness of this new regulation would be enhanced by various market devices, such as corporate bonding, to influence private actors in the marketplace (table 12). This combined strategy would improve current efforts to protect the environment and human health.

An improved contaminated sites assessment process is proposed for British Columbia. This ideal process would have the following characteristics. It would be adopted under a comprehensive policy or regulation, promulgated under the *Waste Management Act*. Its stated objective would be to ensure socially and environmentally acceptable plant decommissionings and site cleanups. The proposed review process would apply to any activity causing, or that has caused, soil, sediment, or associated ground and surface water contamination. The review process would be regulated by BC Environment. The ministry would continue to supply information and advice to stakeholders and control the quality of site assessments undertaken by private parties. However, it would also have the authority to intervene in private decision-making if necessary.

Stakeholders would have the following roles. A proponent would be responsible for all assessment and remediation activities, thus invoking the "polluter pays" principle. Municipalities would be required to acknowledge toxic real estate in their land use policies. They would be given an expanded role in a consultative decision-making process, and some management activities could be delegated to local governments. The public, as a major stakeholder, would be empowered through public-participation provisions in the *Waste Management Act*.

Site cleanup would be based on several assessment and remediation criteria beyond the numerical criteria outlined in the *Criteria for Managing Contaminated Sites in British Columbia*. These additional criteria include: background contaminant levels;

environmental and human-health risk factors; long-term, cost-effectiveness; treatment implementability; and natural resource recovery. The operative principle would be "cleaner is better, background is best".

The distribution of pertinent information would be improved. All documents pertaining to a site cleanup would be made available to stakeholders at a nominal fee. The ministry would be required to compile and maintain a contaminated-sites registry and a "confirmed-release" list on a regular basis. To ensure that public health and environmental requirements are adequately addressed, the ministry would also have the option of registering residual contamination on land title.

Additional compliance and enforcement provisions would be implemented. A certificate of compliance, issued by BC Environment, would be routinely required before land redevelopment is approved. In terms of enforcement provisions, the ministry would be given the authority to issue an order for remediation, or alternately, an order to undertake a characterization study. Finally, the ministry would have the authority to place a fine on a chronic noncomplier.

This assessment process, once implemented, would be self-financing. Government services would be remunerated at market rates. The cleanup of abandoned sites would be accomplished via cost-recovery provisions, from revenues held in trust by the province.

Decision maker would strive for consensus. Further, the duties and requirements of the environment minister would be clearly laid out in legislation. Public participation and intergovernmental review would be a prominent feature of this comprehensive review process. An appeal procedure would also be created to considered concerns of other governments and the public.

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## CRITERIA FOR CONTAMINATED SOIL AND WATER

		Soil			Surface Water and Groundwater		
		mg/kg (ppm) of dry matter			µg/L (ppb) of water		
		A	B	C	A	B <sub>DW</sub>	B <sub>DS</sub> <sup>1</sup>
<b>1. HEAVY METALS</b>							
arsenic	(As)	5	30	50	5	50	50
barium	(Ba)	500 <del>200</del>	500 <del>500</del>	2000	50	1000	1000
cadmium	(Cd)	1.0	5	20	1	5	5
chromium	(Cr)	20	250	800	15	50	50
cobalt	(Co)	15	50	300	10		50
copper	(Cu)	30	100	500	25	1000	100
lead	(Pb)	50	500	1000	10	50	50
mercury	(Hg)	0.1	2	10	0.1	1	1
molybdenum	(Mo)	4	10	40	5		500
nickel	(Ni)	20	100	500	10		500
selenium	(Se)	2	3	10	1	10	10
silver	(Ag)	2	20	40	5	50	50
tin	(Sn)	5	50	300	10		500
zinc	(Zn)	80	500	1500	50	5000	200
<b>2. OTHER INORGANICS</b>							
bromide (free)	(Br)	20	50	300			
cyanide (free)	(CN free)	1	10	100	40	200	
cyanide (total)	(CN total)	5	50	500	40		100
fluoride (free)	(F free)	200	400	2000			
sulfur (total)	(S total)	500	1000	2000			
<b>3. MONOCYCLIC AROMATIC HYDROCARBONS (MAHs)</b>							
benzene		0.1	0.5	5	0.5		0.5
ethylbenzene		0.1	5	50	0.5		
toluene		0.1	3	30	0.5		
chlorobenzene		0.1	1	10	0.1		
1,2-dichlorobenzene		0.1	1	10	0.2		
1,3-dichlorobenzene		0.1	1	10	0.2		
1,4-dichlorobenzene		0.1	1	10	0.2		
xylene		0.1	5	50	0.5		
styrene		0.1	5	50	0.5		
<b>4. PHENOLIC COMPOUNDS</b>							
nonchlorinated phenols (each) <sup>2</sup>		0.1	1	10	0.1	2	
chlorophenols (each) <sup>3</sup>		0.1	0.5	5	1.0		
chlorophenols (total)		0.1	1.0	10	1.0	5	

	Soil			Surface Water and Groundwater		
	mg/kg (ppm) of dry matter			µg/L (ppb) of water		
	A	B	C	A	B <sub>DW</sub>	BDS <sup>1</sup>
<b>5. POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)</b>						
benzo[a]anthracene <sup>4</sup>	0.1	1	10	0.01	0.1	0.01
1,2-benzanthracene 7,2-dimethyl	0.1	1	10	0.1		
dibenzo[a,h]anthracene <sup>4</sup>	0.1	1	10	0.01	0.1	0.01
chrysene	0.1	1	10	0.1		
3-methylcholanthrene	0.1	1	10	0.1		
benzo[b]fluoranthene <sup>4</sup>	0.1	1	10	0.01	0.1	0.01
benzo[j]fluoranthene	0.1	1	10	0.1		
benzo[k]fluoranthene <sup>4</sup>	0.1	1	10	0.01	0.1	0.01
benzo[g,h,i]perylene	0.1	1	10	0.1		
benzo[c]phenanthrene	0.1	1	10	0.1		
pyrene <sup>4</sup>	0.1	10	100	0.2	2	
benzo[a]pyrene <sup>4</sup>	0.1	1	10	0.01	0.1	0.01
dibenzo[a,h]pyrene	0.1	1	10	0.1		
dibenzo[a,i]pyrene	0.1	1	10	0.1		
dibenzo[a,l]pyrene	0.1	1	10	0.01	0.1	
indeno[1,2,3-cd]pyrene <sup>4</sup>	0.1	1	10	0.1		0.01
acenaphthene	0.1	10	100	0.5		
acenaphtylene	0.1	10	100	0.5		
anthracene	0.1	10	100	0.2		
fluoranthene	0.1	10	100	0.1		
fluorene	0.1	10	100	0.1		
naphthalene <sup>4</sup>	0.1	5	50	0.2	2	
phenanthrene <sup>4</sup>	0.1	5	50	0.2	2	
PAHs (total)	1	20	200	0.2		
<b>6. CHLORINATED HYDROCARBONS</b>						
aliphatic						
(each) <sup>5</sup>	0.3	5	50	0.1		
(total) <sup>5</sup>	0.3	7	70	0.1		
chlorobenzene <sup>6</sup>						
(each)	0.1	2	10	0.3		
(total)	0.1	4	20	0.3		
hexachlorobenzene	0.1	2	10	0.1		
polychlorinated biphenyls <sup>7</sup>	0.1	5	50	0.1		3



	Soil mg/kg (ppm) of dry matter			Surfacewater and Groundwater <sup>8</sup> µg/L (ppb) of water		
	A	B	C	A	B <sub>DW</sub>	B <sub>DS</sub> <sup>1</sup>
<b>7. PESTICIDES</b>						
a) <u>Organochlorinated</u>						
aldrin				0.05	0.7	
dieldrin				0.05	0.7	
chlordane (total isomers)				0.05	7	
DDT				0.05	30	
endrin				0.05	0.2	
heptachlor epoxide				0.05	3	
lindane				0.05	4	
methoxychlor				0.05	100	
b) <u>Carbamates</u>						
carbaryl				0.05	70	
carbofuran				0.05		
c) chlorphenoxycarboxylic						
2,4-D				0.05	100	
2,4,5-TP				0.05	10	
d) <u>Organophosphates</u>						
diazinon				0.05	14	
fenitrothion				0.05		
parathion				0.05	35	
methyl parathion				0.05	7	
e) <u>Bipyridyl compounds</u>						
diquat				0.05		
paraquat				0.05		
f) <u>Trichloroacetates</u>						
pichloram				0.05		
pesticides (total)	0.1	2	20	0.05	100	
<b>8. GROSS PARAMETERS<sup>8</sup></b>						
mineral oil and grease	100	1000	5000	100		
light aliphatic hydrocarbons	100	150	800	1000		

## FOOTNOTES

1. To be used as de minimus criteria only.
2. Non-chlorinated phenolic compounds, which include:
 

2,4- dimethylphenol	4-nitrophenol
2,4-dinitrophenol	phenol
2-methyl-4,6-dinitrophenol	cresol (ortho, meta, and para)
2-nitrophenol	
3. Chlorophenols, which include:
 

orthochlorophenol	2,3,6-trichlorophenol
metachlorophenol	2,4,5-trichlorophenol
parachlorophenol	2,3,5-trichlorophenol
2,6-dichlorophenol	2,3,4-trichlorophenol
2,5-dichlorophenol	3,4,5-trichlorophenol
2,4-dichlorophenol	2,3,5,6-tetrachlorophenol
3,5-dichlorophenol	2,3,4,5-tetrachlorophenol
2,3-dichlorophenol	2,3,4,6-tetrachlorophenol
2,4-dichlorophenol	pentachlorophenol
2,4,6-trichlorophenol	
4. If a site is contaminated with coal tars, these are the criteria that apply.
5. Volatile chlorinated aliphatic hydrocarbons, which include:
 

chloroform	1,2-dichloropropene (cis and trans)
1,1-dichloroethane	1,1,2,2-tetrachloroethane
1,2-dichloroethane	tetrachloroethene
1,1-dichloroethene	carbon tetrachloride
1,2-dichloroethene	1,1,1-trichloroethane
dichloromethane	1,1,2-trichloroethane
1,2-dichloropropane	trichloroethene
6. Chlorobenzenes, which include:
 

trichlorobenzenes (all isomers)	pentachlorobenzene
tetrachlorobenzenes (all isomers)	
7. Polychlorinated biphenyls, which include:
 

Arochlors 1242, 1248, 1254 and 1260
8. To be used as investigation criteria only.