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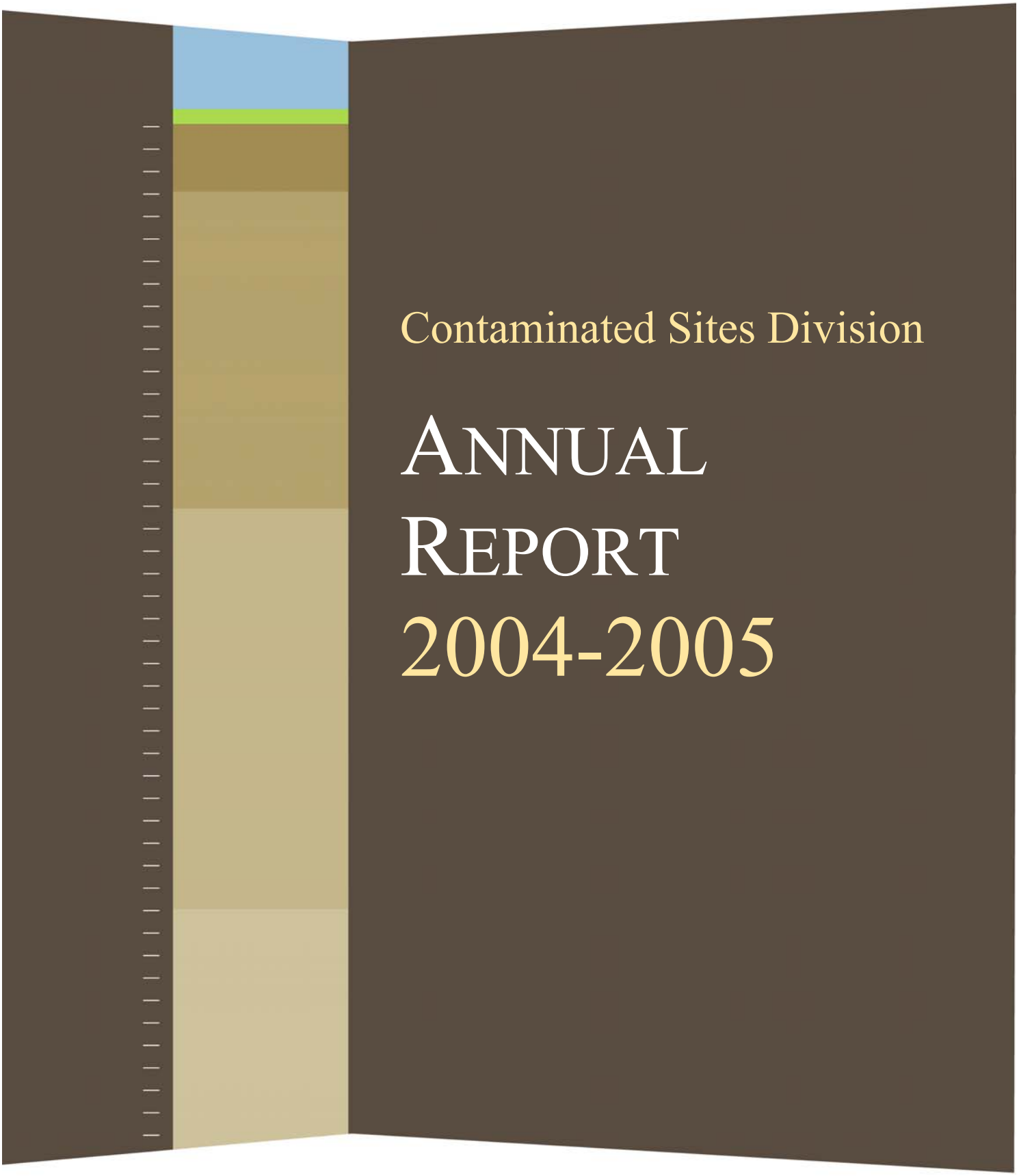

Contaminated Sites Division

Annual Report 2004-2005

Canada

Contaminated Sites Division

ANNUAL REPORT 2004-2005

Prepared by:

Contaminated Sites Division
Health Impacts Bureau
Safe Environments Programme

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List of Organizations and Abbreviations

Agriculture and Agri-Food Canada (AAFC)

Atlantic Risk-Based Corrective Action (ARBCA)

British Columbia Institute of Technology (BCIT)

British Columbia Science Advisory Board on Contaminated Sites (BC SABCS)

Canada Customs and Revenue Agency (CCRA)

Canada-Wide Standards on Petroleum Hydrocarbons (CWS PHCs)

Canadian Council of Ministers of the Environment (CCME)

Canadian Environmental Assessment Act (CEAA)

Canadian Food Inspection Agency (CFIA)

Canadian Environmental Protection Act (CEPA)

Contaminated Sites Division (CSD)

Contaminated Sites Management Working Group (CSMWG)

Correctional Services Canada (CSC)

Defence Construction Canada (DCC)

Department of Fisheries and Oceans (DFO)

Department of National Defence (DND)

Environment Canada (EC)

Environmental Health Assessment Services (EHAS)

Environmental Health Science Bureau (EHSB)

Federal Contaminated Sites Accelerated Action Plan (FCSAAP) - Federal Contaminated Sites Action Plan (FCSAP)

Federal-Provincial Toxic Chemicals Committee (FPTCC)

Geological Survey of Canada (GSC)

Health Canada (HC)

Indian and Northern Affairs Canada (INAC)

International Programme on Chemical Safety (IPCS)

Ministry of Water, Lands and Air Protection (British Columbia) (MWLA)

National Capital Region (NCR)

National Health and Nutrition Examination Survey (NHANES)

National Orphaned/Abandoned Mines Initiative (NOAMI)

Natural Resources Canada (NRCan)

Parks Canada Agency (PCA)

Partnership in RBCA (risk-based corrective action) Implementation (PIRI)

Public Works and Government Services Canada (PWGSC)

Soil Quality Guidelines Task Group (SQGTG)

Transport Canada (TC)

Treasury Board (TB)

Warfare Agents Disposal Working Group (WADWG)

Water Quality and Health Bureau (WQHB)

List of Terms and Abbreviations

Human health risk assessment (HHRA)

Human health risk assessment for biological contaminants (BIOHHHRA)

Human health risk assessment for radiological contaminants (RADHHHRA)

Human health site-specific risk assessment (HHSSRA)

Polychlorinated biphenyls (PCB)

Reference exposure level (REL)

Risk Based Corrective Action (RBCA)

Results-based Management and Accountability Framework (RMAF)

Screening-level risk assessment (SLRA)

Preliminary Quantitative Risk Assessment (PQRA)

Site-specific risk assessment (SSRA)

Tetrachloroethylene (TCE)

Toxicological reference value (TRV)

1. Introduction

1.1 Context

In June 2003, Health Canada received financial support from the Treasury Board to participate as an expert support department in the Federal Contaminated Sites Accelerated Action Plan (FCSAAP), now just the Action Plan (FCSAP). This plan is dedicated to identifying and assessing federal contaminated sites considered to be of high risk to human health or to the environment and to fund necessary remediation or risk management strategies. In Health Canada's *Contaminated Sites Program 2003/2004 Annual Progress Report*, it was noted that the full implementation of Health Canada's Contaminated Sites Division (CSD) was conditional to the continued funding through 2007-2008. Treasury Board granted that funding to the department in 2004.

As an expert support department, Health Canada's core activities in the FCSAAP include (see Annex 1): provision of advice and information, third-party peer review, preparation and delivery of guidance materials, and training.

1.2 Health Canada's Results-based Management and Accountability Framework

Health Canada's CSD Results-based Management and Accountability Framework (RMAF) provides the template for the CSD's 2004-05 Annual Report, as it did for 2003-04.

2. Activities

Health Canada's Contaminated Sites Division (CSD) activities for 2004-05 are summarized in Figures 1 and 2. The outputs and contributions of the Department's CSD activities in 2004-2005 are detailed in Tables 1 to 4.

Figure 1: Summary of Health Canada's Contaminated Sites Division Activities

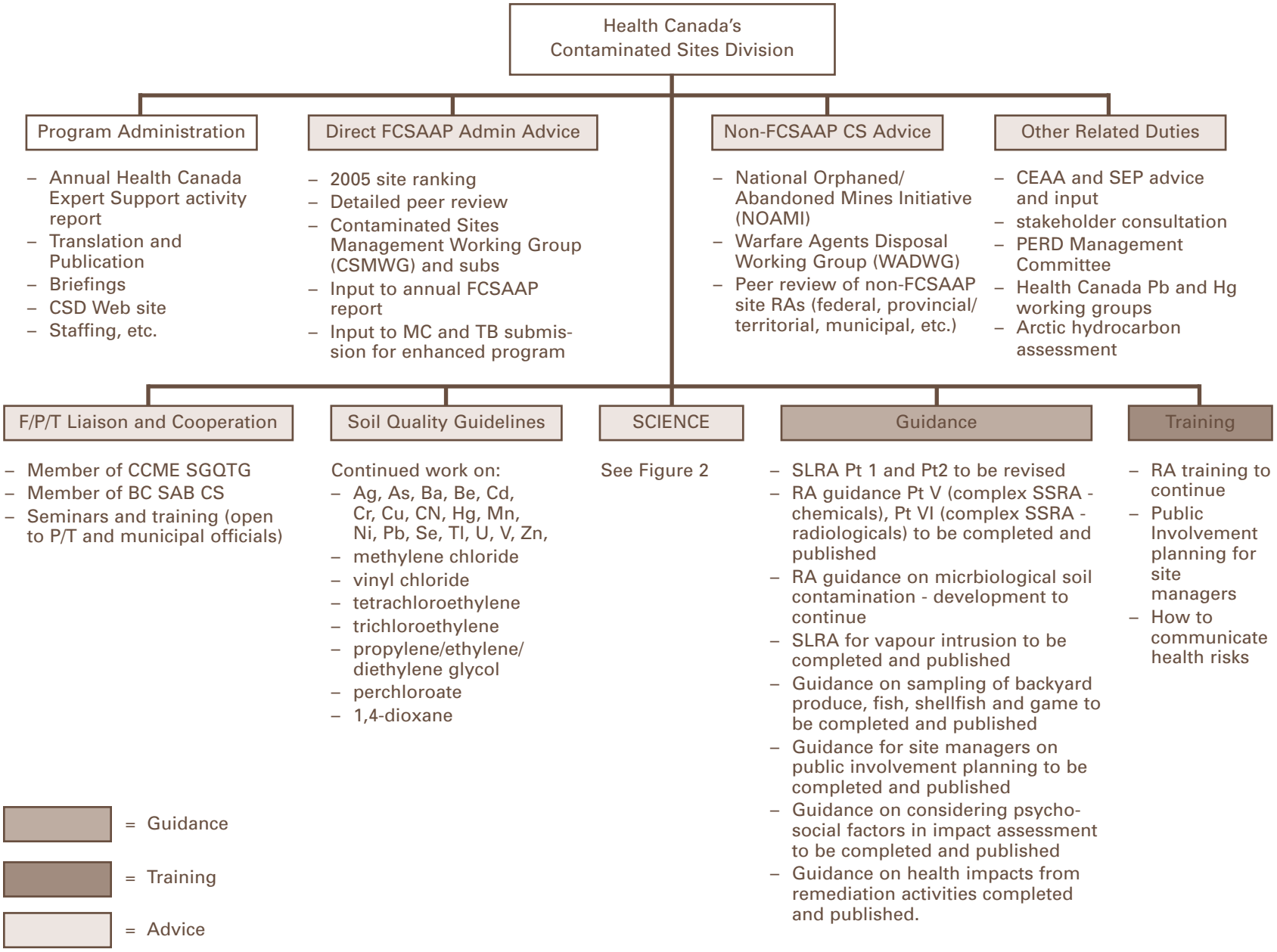

Figure 2: Summary of Health Canada's Scientific Investigations Relating to Contaminated Sites

- **Mixtures**
  - Analysis of mixtures at federal sites
  - Review of RA approaches
  - Genotoxicity of soil-borne mixtures
- **Bioavailability**
  - Dermal
  - Oral
  - Pulmonary
  - Database on oral bioavailability of As, Pb and Cd
  - Review of soil analytical methods for comparability to bioavailable fraction
- **Toxicology**
  - Hg vapour
  - Low mol. Wt. hydrocarbons
  - Hight mol. Wt. hydrocarbons
  - Pb
  - Review of toxicology, TRVs and tissue guidelines for PCBs
- **Indoor dust**
  - In-house analytical capability
- **Risks from remedial technologies**
- **Modelling**
  - Predicting plant uptake from soil concentrations
  - Screening air dispersion model (soil particles; stack emissions)
  - Comparison of a variety of environmental fate models
  - Comparison of CWS PHC, Atlantic Risk-Based Corrective Action (ARBCA) and state-of-science indoor intrusion models
- **Natural sources and levels of metals in CDN soils**
  - Database of F/P/T soil geochemical surveys (GSC)
  - Defining CDN 'background' for U, Pb, Ni (GSC)
- **Risk assessment methods**
  - Inter-provincial comparison of variation in contaminated site risk assessment results
  - Quantification of background daily intake for Ba, Be, Ni using probabilistic methods
  - Review and revision of the practice of exposure "amortization" in cancer risk estimation as applied to contaminated sites

Table 1: Setting Expectations and Plans

Output	Selection Criteria
Contaminated Sites Selection Criteria	■ In 2003-2004, Health Canada requested HHRAs, following its preliminary quantitative risk assessment (PQRA) guidance as a minimum requirement for federal contaminated sites to be considered by the department for site ranking. In 2004-05, parts 1, 2, 3 and 4 of the PQRA guidance were completed and published (see under section Guidelines and Guidance, Table 2.1 for the complete list of Health Canada's CSD current and in-progress publications).
Priority Plans/Lists	■ 2004-2005 and 2005-2006 activities, projects and priorities were discussed with CSD staff, various Health Canada groups, and other federal departments involved in the Federal Contaminated Sites Management Working Group. ■ Furthermore, a Consultative Committee to the CSD was created to provide advice on research and project priorities. Members of this Committee include: CCME Soil Quality Guideline Task Group; BC Science Advisory Board on Contaminated Sites; Atlantic Partnership in RBCA Implementation (PIRI); and Environment Canada.
Performance Plan	■ The 2003-2004 Annual Progress Report was developed to assess the progress of the CSD. The document was published and made available on the CSD Website. ■ Under the CSD RMAF, the first and second year evaluations are formative. The third year evaluation, planned next year, includes surveys to evaluate the performance of the CSD. ■ An update of the current RMAF is planned in 2005, to reflect the evolution of the CSD.
Human Resources Plan	■ To provide services to custodial departments and to deliver on its commitments, Health Canada initiated staffing actions in NCR and its six regions to hire specialized staff. Risk assessment specialist positions in the Atlantic, Quebec, Alberta/NWT and BC/YK regions were staffed on an indeterminate basis. These same regions have also staffed their public involvement positions, but on a temporary basis, pending resolution of job descriptions, classification, and staffing mechanisms. The Ontario/Nunavut region risk assessment specialist position was staffed temporarily in 2004-05 and is now proceeding with a staffing action to secure a qualified candidate on an indeterminate basis. In NCR, the public involvement position was staffed indeterminately. ■ The Manitoba/Saskatchewan regional positions (both for risk assessment and public involvement) remained unstaffed in 2004-05. Staff of other regions and the NCR shared the workload arising from sites and contacts in that region. ■ Consultation is currently taking place in order to reach a consensus on the job descriptions for the Regional Public Involvement Specialist positions. ■ Three graduate students (2 in NCR and 1 in the Quebec region) were staffed temporarily to contribute to and assist with workload, and to gain experience with the CSD. ■ Due to burgeoning workloads resulting from a high demand for review of and input to risk assessments, and for input to site risk management plans, new resources requirements are currently being considered to provide additional regional and NCR resources in support of contaminated sites risk assessment, management and communication projects.

Table 2: Coordinating and Communicating Health Risk Information

Output	Selection Criteria
Correspondence	■ Briefings (17) to Health Impact Bureau Director and more senior management, on program management issues, interdepartmental meetings and new resources requirements requests. ■ Numerous ongoing routine voice and e-mail correspondence, and meetings, with contaminated sites managers in custodial departments on human health risk assessment and public involvement issues. ■ Answers to public inquiries via the contaminated sites Web site and our generic e-mail address: 49 requests received in 2004 and over 30 between January and March 31, 2005. ■ Contribution to the department response to Environmental Petitions 50 B and 132.
Guidelines and Guidance	■ The CSD is in the process of developing and publishing parts of its planned series on human health risk assessment guidance for federal contaminated sites in Canada. Parts I to IV have been translated and formally published in 2004-2005: – ***Part I**: Human Health Preliminary Quantitative Risk Assessment (PQRA)* – ***Part II**: Health Canada Toxicological Reference Values (TRVs)* – ***Part III**: Guidance on Peer Review of Human Health Risk Assessments for Federal Contaminated Sites in Canada* – ***Part IV**: Spreadsheet Tool for Human Health Preliminary Quantitative Risk Assessment (PQRA)* ■ Parts V, VI, and VII were drafted in 2004-2005 and will be published, following consultations with stakeholders, in 2005-2006. – ***Part V**: Complex Site-Specific Human Health Risk Assessment for Chemical Contaminants (CHEMSSRA)* **(in progress)**; – ***Part VI**: Complex Site-Specific Human Health Risk Assessment for Radiological Contaminants (RADSSRA)* **(in progress)**; – ***Part VII**: Complex Site-Specific Human Health Risk Assessment for Microbiological Contaminants (BIOSSRA)* **(in progress)**. ■ Preliminary quantitative risk assessment guidance documents (Parts I to IV) were submitted to the CCME for consideration as national guidance on human health risk assessment under that organization. A decision in this respect is pending. ■ Work was initiated in 2003-04 and 2004-05 on 31 human health soil quality guidelines, in collaboration with Environment Canada, and the CCME Soil Quality Guideline Task Group. New soil quality guidelines are being developed for Antimony, Barium, Beryllium, Chlorinated Phenols (mono/di/tetra/penta), Chlorobenzenes (di/tri/tetra/penta+ isomers), Cyanide, Copper, Dichloromethane (methylene chloride), Dioxane (1,4), Dioxins/Furans, Manganese, Molybdenum, Nickel, Perchlorate, Petroleum hydrocarbons (PHC), Polychlorinated biphenyls (PCBs), Propylene/ethylene/diethylene glycols, Selenium, Silver, Styrene, Thallium, Trichloroethylene, Uranium, Vanadium, Vinyl chloride, Zinc. Updated soil quality guidelines are being developed for Arsenic, Cadmium, Chromium, Lead and Mercury.

Table 2 (cont'd)

Output	Selection Criteria
Guidelines and Guidance (cont'd)	■ The draft guidance document: *An approach to identify and mitigate health impact and risks associated with contaminated sites remediation technologies* was completed and is to be published in 2005-2006. ■ Data compilation continued for the update of the *Compendium of Canadian Exposure Factors for Risk Assessment* (1997), identifying further information and data for the Canadian General Population, the First Nations and Inuit. ■ Contribution to the publication of the *Inventory of Federal/Provincial/ Territorial Data relating to environmental and occupational health*. ■ Provision of comments on translation of some CCME documents relating to contaminated sites and environmental health issues.
Scientific Investigations	■ CSD initiated over 55 scientific investigations in 2004-05 alone, with more than 70 being initiated since the inception of Health Canada's Expert Support program in September 2003. Scientific developments are important to human health risk assessment, in order to reduce uncertainties, and to provide the best information available to risk managers as a basis for sound decision making. See the full list of projects in Appendix 3. These investigations resulted in partnerships with other government departments, Health Canada scientists, universities, industries and consultants. Findings are used as a primary basis for the provision of advice, and are incorporated into human health risk assessment guidance. All individual project reports are made available to the public through the CSD Web site once completed and accepted. ■ Other projects initiated in-house by the CSD include: – the summary of available indoor air quality guidelines (for use in risk assessment of indoor environments); – the compilation of physical/chemical properties of contaminants of interest at federal contaminated sites; – a review of approaches for risk assessment of chemical mixtures; – a continuing review of the application of exposure amortization in carcinogen risk assessment; – a review of models used to predict the fate and transport of contaminants in air, soil and groundwater, etc. ■ Investigations undertaken in 2004-05 were peer-reviewed by regional and NCR staff prior to distribution or publication.
Consultations	■ 40 participants from Canadian industries and representatives from the CSD participated in a Workshop on Principles and Practices of Risk Assessment for Selected Contaminated Sites in Toronto, in February 2005. Minutes from the workshop are available upon request through the CSD Web site. ■ Meeting with consulting firms (5) from the Quebec region to discuss Health Canada's PQRA guidance (a similar meeting was held in 2003-2004 with other consultants from across the country). Comments were discussed and considered for inclusion in revisions to the PQRA guidance documentation. Proceedings of these meetings are available through the CSD Web site.

Table 2 (cont'd)

Output	Selection Criteria
Meetings/Presentations	■ The CSD continued its participation in national and provincial/territorial working groups to discuss environmental health issues of relevance to contaminated sites. ■ As an expert support department under the FCSAAP, the CSD participated in and made presentations to the federal Contaminated Sites Management Working Group and its subcommittees (10 meetings in 2004-2005). At the regional level, similar meetings took place through the Interdepartmental Regional Working Group. Health Canada representatives participated in meetings in all regions: Ontario, BC/Yukon, Manitoba/Saskatchewan, Alberta/NWT, Quebec and the provinces of the Atlantic. ■ Presentation of the peer review checklist for risk assessment. Staff in BC provided a brief overview and dissemination of the information/reports to the regional interdepartmental working group. ■ Participation in other national working groups, including the Warfare Agent Disposal Working Group, the National Orphaned and Abandoned Mines Advisory Committee, and the Program on Energy Research and Development at National Resources Canada. ■ Participation, along with Environment Canada, in meetings of the Canadian Council of the Ministers of the Environment Soil Quality Guidelines Task Group (one meeting and one conference call per month), and in a Joint meeting of CCME Soil and Water Quality Task Groups. ■ Participation in a DFO FCSAAP expert support workshop attended by regional DFO staff in Vancouver, BC. The objective was to provide an overview and context of Health Canada expert support activities regarding federal contaminated sites, to assist DFO in formulating their expert support program. ■ Regional meetings with contaminated sites provincial authorities in Ontario, Alberta (Health and Wellness), and the Newfoundland Department of the Environment. ■ Participation in 3 departmental working groups: Health Canada's mercury, lead and perchlorate working groups. ■ Participation in a meeting on the Food and Nutrition Surveillance System, organized by Statistics Canada. ■ Participation in site-specific committees, for example the Valcartier Groundwater Quality committees (4 meetings) with DND-Valcartier, Defence Research and Development Canada, Environnement Québec, Ministère de la Santé et des Services Sociaux, municipal representatives (Shannon, Val Bélair, Québec), citizens of Val Bélair and Shannon, environmental groups. ■ Other meetings which the CSD staff attended included: the Lachine Canal Contaminated Site Remediation, in collaboration with Parks Canada (3 meetings), the Lac St-Pierre site rehabilitation (2 meetings, 1 full-day workshop), a meeting with the Contaminated Sites Biotechnology Research Institute (Montreal) which lead to further collaboration on PCB toxicology, meeting on contaminated sites research with the Institut National de Santé Publique du Québec risk assessment group research project, meeting on Perchlorate in drinking water and to discuss a proposed Health Canada guidance value with provincial drinking water representatives (Ministère de la Santé et des Services Sociaux, Environnement Québec), and discussions on environmental health issue with the Ministère de la Santé et des Services Sociaux, the Institut National de Santé Publique du Québec and Environnement Québec.

Table 2 (cont'd)

Output	Selection Criteria
Meetings/Presentations (cont'd)	■ Presentation to the Society of Risk Analysis annual meeting in the United States on Health Canada's approach to the identification and mitigation of impacts associated with remediation technologies. ■ Presentation to the Atlantic Contaminated Sites Conference in St. John's, Newfoundland on human health risk assessment of contaminated sites. ■ Presentation to the International Association for Impact Assessment Conference in Vancouver on Health Canada's human health risk assessment approach. ■ Presentation of a poster entitled "Hydroelectric Development: Factors to consider in methyl mercury risk assessment and management" at five events: Health Canada Research Forum, Journées annuelles de la santé publique au Québec, Canadian Society of Toxicology, Écodéfi Health Canada Health Products and Food Branch annual meeting. ■ Presentation to the Atlantic PIRI (Partnership in Risk Based Corrective Action [RBCA] Implementation). ■ Attended presentation on DFO site-specific intervention levels for light stations in Atlantic Region.
Communication Materials	■ Creation of a CSD identity (Report Cover, CD Label, Fact Sheet Templates, PowerPoint® Templates). ■ Shared drive created for access to all documents by CSD regional and NCR staff. ■ Establishment of a central CS e-mail and mailing list (58 members subscribed to date). ■ Compilation of contaminated sites regional, provincial and municipal contacts for a central stakeholders' database. ■ Two media interviews (*Le Soleil* [Quebec City daily] and Radio-Canada Québec) regarding perchlorate in drinking water at Valcartier. ■ Contributed to preparation of public information sheet and Qs & As on perchlorate. ■ Article published in *Intracom*, Health Canada's magazine, on the CSD.
Web Site	■ Development, launch (in 2004) and continuous updating of the Health Canada Contaminated Sites Web site. http://www.hc-sc.gc.ca/ewh-semt/contamsite/index_e.html http://www.hc-sc.gc.ca/ewh-semt/contamsite/index_f.html

Table 3: Providing Advice/Peer Reviews

Output	Selection Criteria
Consultations	■ Under the FCSAAP funding process, the CSD staff peer-reviewed 20 new preliminary quantitative risk assessments (PQRA) (listed under Appendix 2) from custodial departments and ranked a total of 110 federal contaminated sites, including projects ongoing from last year. The ranking was provided to the FCSAAP Secretariat to establish a priority list for funding of remediation and/or risk management activities under FCSAAP. ■ At the request of federal departments, provincial and municipal jurisdictions, the CSD staff provided peer review and advice on contaminated sites human health risk assessments and risk management plans for some sites and issues not specifically funded under FCSAAP. In many cases, departmental representatives met and discussed human health issues with contaminated sites managers. Occasionally, CSD staff visited certain contaminated sites. Sites/issues in which we were involved in 2004-2005 included: **Ontario and Nunavut:** Le Breton Flats infrastructure and remediation project, Ontario (National Capital Commission); Moose Factory, Ontario (Health Canada); Kingfisher Lake, Ontario (INAC); Biosolids Pellet Review Study – Human health and Ecological Risk Assessment (City of Toronto/Toronto Public Health Department, Ontario); Talfourd Creek – review of environmental contamination data (FNIHB, Health Canada). **Atlantic:** Shannon Park, Darmouth, Nova Scotia (DCC); North Side Lower Zeke Brook, 14 Wing Greenwood, Nova Scotia (DND/DCC); Twin Falls (provincial agency, NF/LB Hydro and Churchill Falls, Labrador, Corporation.) Saglek (DND); Goose Bay, Newfoundland and Labrador, (DND/DCC); Alexander Lake, Newfoundland and Labrador, (DND/DCC); PEI site (PWGSC); Newdock, St. John's, Newfoundland (PWGSC); Halifax Port Authority, Winlie Property, Nova Scotia (TC); Atlantic Institution, New Brunswick (CSA); Shea Heights, Newfoundland and Labrador (DND); Amherst Aerospace, Nova Scotia (PWGSC); Port aux Basques Harbour, Newfoundland and Labrador, (TC); Sandwich Point, Nova Scotia (DND); Light stations, Atlantic Region (DFO/PWGSC); Marrach Landfill – Cape Breton, Nova Scotia, (PCA); Hopedale Labrador (Newfoundland and Labrador, Labrador and Inuit Association).

Table 3 (cont'd)

Output	Selection Criteria
Consultations (cont'd)	**British Columbia and Yukon:** Ship Repair Zone DY-4 (CFB Esquimault) (DND/DCC); Point of Pleasant Camp. Boarder Crossing Facility, Point Pleasant (PWGSC); Red Bridge, Kamloops (PWGSC); Point Atkinson Light Station and Park, West Vancouver (DFO); Snootli Creek, Bella Bella, BC (DFO); Loran-C Antenna Station (Williams Lake); Vernon RA (DND Review and Gap Analysis,); Federal and Canada Post Corporation Buildings. 940 and 950 Alder Street, Campbell River (PWGSC); Rock Bay Remediation Project – Stage 1 (TC); West Moberly Report (Health Canada); Administered Seabed in Victoria Harbour's Lower Basin (TC) Tofino airport (TC). Esquimalt Harbour (DND); **Manitoba and Saskatchewan:** Riding Mountain National Park (PCA); Mathias Colomb Cree Nation, Pukatawagan (Health Canada). Bushell Public Port Facility (TC); **Quebec:** Lachine Canal, Montreal (PWGSC); Nitchequon weather station (Transport Canada); Mirabel quarantine site (PWGSC); Valcartier, (DND) Zinc contamination at the Pikogan Reserve (INAC). **General** ■ The CCME consulted Health Canada to review the National Classification System for contaminated sites, and supporting documents for soil quality guidelines on DIPA/Sulfolane, PAH, and Benzene. ■ Consultants routinely contacted CSD staff to obtain advice or guidance ■ The department assisted the Geological Survey of Canada in order to facilitate GSC's survey of environmental consultants to obtain additional data on background soil data from site-specific sampling programs and risk assessments. ■ Other consultations and exchanges on HHRA include: – Advice on UNECE POPS document; – TCE in indoor air and Health Canada's guideline from Calgary Health Department; – Comments on Health Canada's Mercury Website Review; – Exchange of information on TCE and Perchlorate with the Quebec City regional Public Health Department;

Table 3 (cont'd)

Output	Selection Criteria
Consultations (cont'd)	– Microbial Risk Assessment; information provided to Ontario Ministry of the Environment (Microbiological Water Standards); – Review of a draft document on soil-plant transfer models (Health Canada); – Review documents for the British Columbia Science Advisory Board (BC SAB) and attend high risk site workshop; – ARBCA query (DND and Agriculture Canada); – Mussel sampling, Newfoundland (TC), – Metals in blood (DND), – Best practices for creosote storage (NSDEL); – Indoor air quality (PEI Environment); – Risks assoiciated with covered contaminated soil pile on Halifax Port Authority land (Cerescorp); – Peer review of a risk assessment for backyard garden produce in Flin Flon (Manitoba) (Manitoba MOE; Health Canada CEPA Risk Management Division); – Peer review for "Expofacts", a website created by the European Union to make human exposure characterization data available; ■ Staff answered and redirected public inquiries for information such as on drinking water technologies, drinking water guidelines; TRVs for hazardous air pollutants, Health Canada methyl mercury guidelines, Health Canada interest in nanotechnology applications for biomonitoring. ■ Staff were also invited to peer-review scientific articles from other departmental scientists prior to presentation or publication.
Training Workshops	■ Training on deterministic and probabilistic risk assessment methods was delivered in 5 regions (Atlantic, QC, ON, AB/NWT, and BC/YK). Sessions involved 2.5 days of lectures and hands-on computer based exercises. A total of 214 participants attended from federal departments, provincial and municipal agencies: ■ Halifax: 60 participants: DCC-2, DND – 6; DFO-2, EC-4, HC-5, PC-2, PWGSC – 15, RCMP – 1, Others-23. ■ Montreal: 33 participants: INAC-1, CFIA-1, HC-9, DND-1, EC-1, PCA-3, PWGSC-2, TC-2, Others-13. ■ Toronto: 41 participants: NRCan-1, PCA-1, AAFC, 1, DCC-4, DND-8, EC-1, HC-4, PWGSC-5, DFO-3, TC-1, Others-13. ■ Edmonton: 27 participants: CEAA-1, INAC-3, EC-2, DFO-2, HC-7, DND-2, Others-10. ■ Vancouver: 53 participants: DFO-4, DND-1, EC-3, HC-6, INAC-6, PWGSC-2, TC-3, Others-28. ■ Training was made available to provincial and municipal agencies due to the mutual interest and responsibility of federal, provincial and municipal levels of government in resolving contaminated sites issues; a desire to establish effective linkages and common understandings of contaminated sites issues between the various jurisdictions; the general lack of opportunities for risk assessment training in Canada; the fact that the differential cost of providing such training to 50 participants versus 5 or 6 participants is negligible.
Information Briefings	■ See Table 2, Correspondence, for details on briefings produced.

Table 3 (cont'd)

Output	Selection Criteria
Specialized Committees	■ See Table 2, Meetings/Presentation.
Evaluations of Environmental Health Impact Assessment	■ Barren Lands Remediation (Manitoba/Saskatchewan); ■ Gods Lake Narrows (Manitoba/Saskatchewan); ■ Oldman Riger Dam and Reservoir Follow-up Environmental Impact Assessment Working group (Alberta); ■ Le Breton Flats (Ontario); ■ Air quality assessment, Highway 10 Upgrades and Highway 15 Project (British Columbia); ■ Scoping document for Sydney Tar Ponds remediation (Nova Scotia); ■ Sydney Tar Ponds air monitoring info (Nova Scotia); ■ Review of the Goodfish Lake EIA (Alberta); ■ Boat Harbour EA (Atlantic Canada); ■ Provided expertise (methyl mercury risk assessment) for the environmental assessment of hydroelectric development projects (Quebec).

Table 4: Monitoring and Assessing Results

Output	Selection Criteria
Performance reports	■ The 2004-05 Annual Report continues Health Canada's efforts and commitments to report on their delivery of obligations and commitments as an Expert Support department under the FCSAAP.
Evaluation/review reports	■ All training programs delivered by CSD included a participant evaluation. Those evaluations have been reviewed (see Section 3.4) and will be used to help improve the delivery of training and in the development of new programs for federal contaminated sites managers to ensure, to the extent possible, that Health Canada continues to deliver relevant and competent technical training in risk assessment and related subjects.
Lessons learned	■ See Section 3.0.

3. Lessons Learned

3.1 Expectations and Program Delivery

With funding secured until 2007-2008, the CSD was able to plan longer-term activities and projects to fulfill its commitments under the FCSAAP. Health Canada is responding to the needs of custodial departments by engaging in science-based activities to resolve complex issues and reduce uncertainties in the assessment of health risks. The Department is collaborating with scientists, risk managers, industries, consultants and researchers. It has become evident that human health issues are a priority at many federal contaminated sites. As a result, Health Canada may need to focus greater resources towards these issues. Additional resources, as part of an expanded and enhanced federal contaminated sites action plan program, were put forward to Cabinet and Treasury Board, along with other expert support and custodial departments, late in the 2004-05 fiscal year.

Guidance

It was critical that any guidance offered by Health Canada with respect to contaminated site risk assessment be valid, reliable and authoritative. The publication of the PQRA guidance, used to assess and rank human health risks at high priority federal contaminated sites, was subjected to extensive peer review and application. It has received broad acceptance and adoption by risk assessment practitioners and consultants across Canada. Health Canada can now more consistently, objectively and equitably assess and rank the risks posed by federal contaminated sites located across all provinces and territories.

Training

Early in the development of the CSD, numerous challenges were received from custodial departments and others regarding Health Canada's PQRA guidance, risk assessment approach, toxicological reference values and other aspects of contaminated site risk assessment. Those challenges often resulted from differences in understanding of risk assessment concepts and hands-on experience. To increase common understanding and to increase overall contaminated sites risk assessment abilities across government, training was made available to site managers within federal custodial departments. To increase the common understanding of risk assessment between the federal government and other jurisdictions, that training was also opened to provincial and municipal agencies due to the mutual interest and responsibility of federal, provincial and municipal levels of government in resolving contaminated sites issues. Reaching out to other levels of government was also driven by the general lack of opportunities for risk assessment training in Canada, and the fact that the differential cost of providing such training to 50 participants versus 10 participants was negligible.

Advice

Health Canada also recognized the cross-jurisdictional responsibilities and interests concerning contaminated sites. As a result, Health Canada has increased its dialogue with provinces, territories and municipalities. This has been achieved through participation on the CCME Soil Quality Guidelines Task Group (SQGTG) and the BC Science Advisory Board on Contaminated Sites (SABCS), through establishing a consultative committee to contribute to and advise Health Canada on contaminated sites issues, through direct regional

dialogue and consultation with provincial and municipal agencies, and through workshops with consultants and industries. Health Canada engaged the broadest possible input to establishing priorities and activities, while ensuring that the federal prerogative is maintained in decision-making. Priorities for annual activities are discussed within Health Canada, with custodial departments involved in the management of federal contaminated sites (through the CSMWG and regional working groups) and with that Consultative Committee established by the CSD to access broader incite and concurrence on contaminated sites projects. The broader consultation has been initiated as a means of maximizing the relevance of our projects to multiple jurisdictions and departments and preventing duplication at the various levels of government that would otherwise waste taxpayers' money.

Progress in advancing the science of risk assessment was displayed through the publication of new and updated guidance materials, and through the listing of completed reports on our Web site (http://www.hc-sc.gc.ca/ewh-semt/contamsite/index_e.html). Poor access to Health Canada reports and documents has been a recurring theme in discussions with provinces, territories, municipalities, industry and consultants. The Web site listings ensure that other departments, jurisdictions, industries and researchers can learn of our activities and benefit from them prior to initiating their own related projects. Again, efficiency of information dissemination and prevention of duplication are the primary goals.

Industries often possess data and information relevant to studies or resolving contaminated sites issues. However, identifying and accessing that data and information was problematic. Our consultations with industry have been fruitful in securing confidential data from the petroleum industry of direct relevance to at least one project. This is data that we would not have learned of or been able to obtain without those consultations. Likewise, the petroleum industry would not have known of our need without the benefit of those direct consultations. The contribution of that data reduced costs of the project and improved the quality and relevance of the project, thus significantly improving the cost-effectiveness of the activity.

Early in Health Canada's CSD development, it became apparent that custodial departments, industries and others were looking to Health Canada for authoritative advice on contaminated sites issues. As a result, qualified and experienced scientific staff were hired to provide expertise in human health risk assessment. Staff with extensive experience in public involvement have also joined the public outreach/public involvement team. Regional and NCR staffing is still not completed, but significant progress has been achieved.

3.2 Coordinating and Communicating Health Risk Information

Public Outreach/Public Involvement

Health Canada's public outreach activities were launched in earnest in 2004-05. CSD's various consultation activities have made it evident that public involvement is as important as the science in addressing and resolving contaminated sites issues. The public involvement/outreach program, when fully implemented, will ensure consistent messaging to all publics (Canadians in general, specific communities affected by contaminated sites, industries, regulatory agencies, etc.). Through better, stronger, and more consistent engagement of those publics, Health Canada will be able to achieve or contribute to health-effective and cost-effective decision-making.

In 2004-2005, the public involvement/outreach (PI/PO) component of the CSD made great progress. In the fall of 2004, Health Canada began to build its PI/PO team. A senior public outreach specialist joined the contaminated sites team in the NCR and regional staff were hired in the Atlantic, Quebec, Pacific/Yukon and Alberta/NWT regions. The small team of specialists initiated an ambitious program to provide

guidance, training and advice on PI/PO to contaminated site managers of federal custodial departments.

A framework that will clearly outline how the CSD will meet its PI/PO commitments under the FCSAAP is in the early stages of development. A presentation was made to the federal interdepartmental contaminated sites communications network, in which federal custodial departments are represented. Also, fact sheets intended for custodial departments were produced. In addition, three key projects were initiated in 2004-2005:

1. **Guidance** – Document on Public Involvement Planning, Improving Stakeholder Relationships: Public Involvement and Contaminated Sites: A Guide for Site Managers. Release scheduled for Sept. 05.
2. **Training** – Development of Instructors' Manual and participants' Guide for a two-day training course for custodial departments. Improving Stakeholder Relationships: Public Involvement and Contaminated Sites. This training program was pilot tested in April 2005 and rolled out to regions starting in June 2005.
3. **Advice** – Psycho-social information guide, designed to support training programs and function as a stand-alone resource guide. Addressing Psychosocial Factors Through Capacity Building: A Guide for Managers of Contaminated Sites. Release scheduled for Sept. 05

Fact sheets concerning aspects of Health Canada's PI/PO program were also developed and included:

Benefits of Public Involvement;
Public Involvement Program.

Human Health Risk Assessment

2004-2005 has been a remarkable year for the coordination and communication of health risk information. Over 55 scientific investigations were undertaken to investigate or resolve human health risk assessment issues and reduce uncertainties in the assessment of health risks. Departmental staff communicated and shared their knowledge with the public, universities, custodial departments, consultants, industries, working groups, provinces, territories, cities and students. Training on probabilistic risk assessment was delivered to over 200 participants; and numerous additional guidance documents have been drafted that will be published in 2005-06. The CSD consulted with stakeholders to inform them of activities and to seek input, data and information contributions. Communication materials were developed, presentations were made nationally and internationally, and the CSD Web site was launched. It has been a year of consolidating and updating information to provide the best possible up-to-date advice to federal contaminated sites risk managers that will allow them to make appropriate remediation and/or risk management decisions.

With the publication of Health Canada's preliminary quantitative risk assessment (PQRA) guidance, and other guidance, there is now a federal approach to assess health risks from contaminated sites. Prior to the availability of Health Canada's guidance, consultants and federal site managers had to rely on the limited provincial guidance available, or employ methods devised in other countries (such as Risk Assessment Guidance for Superfund [RAGS] from the US EPA). In an analysis conducted for Health Canada, the risks predicted from a single hypothetical site varied widely from one province to another, with the site requiring little or no remediation in one province and extensive clean up in another. Such discrepancies only serve to question the validity of risk assessment in general. If the federal government relied on those different methods, it would raise questions as to the equitable treatment of departments and those Canadians potentially impacted, from one region to another. Therefore, with the publication of the PQRA guidance, the federal government can now ensure that there is consistency in the assessment of health risks from federal contaminated sites, irrespective of their

geographic location, and ensure that site ranking, priority setting, funding allocations and cost efficiency for federal site remediation are comparable and equitable across all provinces and territories. In addition, Health Canada's guidance is 'made in Canada' and considers environmental and legislative characteristics that are unique to this country.

The guidance and training offered by Health Canada are encouraging more consistent messaging of health risks to custodial departments and to Canadians overall. The human health risk assessment advice provided to custodial departments' risk managers is enabling them to make more appropriate responses to health risks and more cost-effective decisions. Where questions remain unanswered, such as the most appropriate approach to mixtures risk assessment, Health Canada has initiated research to fill data and knowledge gaps in order to provide advice and guidance that is valid, defensible and science-based.

3.3 Providing Advice/Peer Reviews

In 2004-05, Health Canada CSD staff provided numerous advice and peer reviews to federal, provincial, territorial and municipal agencies, to consultants and others (see Tables 2 and 3). The CSD has, in less than two years, become an important player on the Canadian contaminated sites scene. Stakeholders now know that they can reach the CSD staff and seek human health risk assessment advice and expertise. The CSD presence in each region also facilitates dialogue between custodial departments, provinces, territories, municipalities and Health Canada. Advice from CSD staff is being routinely solicited, not only on specific sites, but also on provincial, national and international issues. Health Canada is taking the necessary leadership role on contaminated site human health issues and is having a positive impact on the overall management of federal contaminated sites in Canada.

3.4 Monitoring and Assessing Results

The CSD has undergone numerous changes in the past year in order to meet its expert support roles and responsibilities. The CSD has adapted to an increased demand and workload through the hiring of new staff. CSD staff received necessary training to ensure consistency of expertise and of health risk advice delivered. The CSD has been responsive to comments provided by management, other departments, staff and the public in the provision of its services (guidance, training and advice).

Staff received feedback from custodial departments, industry and consultants on the training delivered, the guidance documents published and advice given. In general, the feedback on the probabilistic training course was very positive, with several participants emphasizing the value of the course and the need for more. Most participants considered that the length of the course, the level of detail and the balance between the lecture material and application was right. Provincial/territorial and municipal representatives expressed their appreciation for having been offered the opportunity to improve their risk assessment skills and their understanding of the federal approach.

Many training participants have emphasized their interest in training on the preparation of statements of work and requests for proposals for human health risk assessment contracts. In response to this interest, Health Canada assisted one custodial department in the development of a generic statement of work, and the CSD will establish a working group with custodial departments in 2005-06 to develop general terms of reference for use by all departments.

Feedback has been very positive on the guidance documents published by Health Canada. Some departments are now using Health Canada's Peer Review Checklist routinely. To improve our communication and distribution of training materials, some departments had suggested that our materials be posted on

the Web site. Our website is now being used to distribute these materials and other reports and materials prepared under our Expert Support program.

There has been considerable interest from custodial departments and their consultants in our research reports. Other federal departments have expressed their satisfaction with the amount of research projects being conducted by the department. Additionally, people have expressed strong interest in Health Canada completing the guidance documentation for complex site-specific human health risk assessment (intended as part V in Health Canada's series of contaminated site risk assessment guidance documents), as this will be valuable for sites with more complex problems.

4. Concluding Remarks

Major advances were made in 2004-05 in the implementation of Health Canada's expert support contaminated sites division. The demand for CSD services grew, due both to the increased number of contaminated sites that are being addressed by the federal government, and due to increased recognition of Health Canada's expertise and role in the federal contaminated sites action plan (FCSAAP). Health Canada will continue to plan its activities to best meet its commitments under the FCSAAP, and to better deliver its services on human health issues and public involvement associated with contaminated sites. Consultation with all levels of government, industry and others will be continued to ensure the broadest possible application, relevance and dissemination of Health Canada reports, guidance, training and advice.

Annex 1: Health Canada's Roles and Responsibilities under the Federal Contaminated Sites Action Plan

Health Canada has a key support role and the responsibility to provide technical and expert advice to the ADM's Steering Committee and to custodial departments on human health risks relating to federal contaminated sites. The contaminated sites activities of the Office of Environmental Health Assessment Services (EHAS) are all in support of this function.

Health Canada received funding of $2.6M for its CSD for 2003-2004 based on its 1st FCSAAP Treasury Board (TB) submission, and the Department's commitments outlined in this first submission have been delivered. For years 2-5 of the Accelerated Action Plan, Health Canada is seeking a total of $4M for the CSD. The Department's commitments to the Treasury Board under the FCSAAP include:

- Providing expert advice to the Secretariat to ensure the development and implementation of a scientifically defensible ranking system for project selection under the Action Plan;
- Developing standardized, science-based approaches to assessing the human health and environmental risks associated with contaminated sites; and providing guidance materials and training to custodial departments, based on these approaches;
- Providing expert advice and guidance to custodial departments on identifying contractors, developing requests for proposals, and reviewing proposals for human health risk assessments;
- Undertaking expert third-party peer review of human health risk assessments of federal contaminated sites;
- Providing expert advice to custodial departments in the NCR and the Regions, concerning the best practices and management options for the remediation/risk-management of federal contaminated sites, so that risks to human health and the environment are eliminated or minimized;
- Providing public involvement advice, guidance material, and training to enable custodial departments to implement meaningful public involvement strategies through all stages of site identification, assessment and remediation.
- Promoting regulatory compliance at federal sites and ensuring that site remediation/risk management decisions are consistent with federal environmental policies and management objectives;
- Serving as liaison between federal departments and provincial and territorial ministries of health and of environment, and between federal departments and Aboriginal peoples on health and environmental issues; and
- Supplying specialist or expert information or knowledge in order to conduct or contribute to environmental assessments pursuant to the *Canadian Environmental Assessment Act*.

ANNEX 2: HEALTH CANADA FEDERAL CONTAMINATED SITES "EXPERT SUPPORT" PROGRAM PROJECTS CONDUCTED IN FISCAL YEARS 2003-04 AND 2004-05

FY	Contractor	Project Description	Rationale
Sampling Methods			
2003-04	Golder Associates	Guidance on sampling backyard produce and wild vegetation used as food, to produce reliable data for use in risk assessments.	Contaminant uptake into plants used as food is often a critical exposure pathway in contaminated site risk assessment, particularly for residential properties with backyard gardens. Guidance on sampling strategies will aid in ensuring that the resulting data are sufficient and suitable for risk assessment purposes.
2004-05	Dillon Consulting	Guidance on sampling of fish, shellfish and game, and statistical analysis and interpretation for use in risk assessments.	Contaminant uptake into fish, shellfish and game used as food is often a critical exposure pathway in contaminated site risk assessment, particularly for wilderness or remote sites, or those in close proximity to communities that rely on hunting and fishing for subsistence. Guidance on sampling strategies and data analysis will aid in ensuring that the resulting data are sufficient and suitable for risk assessment purposes.
Soil Quality Guidelines			
2004-05	CCME	Revision, translation and publication of the *Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines*.	Health Canada is a member of the CCME Soil Quality Guidelines Task Group (SQGTG) and follows the *Protocol* when deriving soil quality guidelines to protect human health. The *Protocol* was first released in 1996 and now requires updating to reflect current science and improvements to the guidelines-setting process.
2004-05	Geological Survey of Canada	Quantification of national and regional background (natural) concentrations of metals in Canada, for inclusion in supporting documents for human health-based soil quality guidelines.	Soil quality guidelines cannot be set below naturally occurring levels in soils. GSC is the federal authority on soil geochemistry. GSC has been commissioned by Health Canada to recommend national and regional background levels of a variety of inorganic elements to ensure that available data are not omitted, misinterpreted nor misrepresented.
2004-05	Wilson Scientific	Update and revision of the draft soil quality guidelines supporting for human health soil quality guidelines for uranium.	The draft document being circulated by CCME for comment dates to 1998, and does not reflect the current understanding of toxicology of uranium, nor background levels of U in the Canadian environment.
2003-04; 2004-05	Multiple contractors; Health Canada-NCR	Development of scientific supporting documents for human health-based soil quality guidelines, for contaminants of specific concern to federal departments.	Human health-based soil quality guidelines are required for a variety of contaminants of specific interest to federal departments. Substances of on-going work include: Ag, As, Ba, Be, Cd, Cu, CN, Hg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn, Dichloromethane, Vinyl chloride, Trichloroethylene, Ethylene-/Diethylene-/Propylene-Glycols, chlorobenzenes, PCBs, dioxins/furans, chlorinated phenols.

FY	Contractor	Project Description	Rationale
2004-05	URS	Develop and test 'High Priority Trigger Values' to aid in the prioritization of federal sites for FCSAAP funding. In association with the BC Science Advisory Board on Contaminated Sites.	A means of more rapid and defensible ranking of sites for FCSAAP funding is required, particularly for sites where remedial costs are relatively low, making the conduct of SLRA inappropriate on a cost basis (relative to the likely cost of remediation/risk management). It is anticipated that trigger values can be developed that retain a basis in risk assessment and that can be employed to rank sites without need of SLRA. The trigger values must be determined on a chemical-by-chemical basis to ensure maximum defensibility and basis in science and risk. The proposed trigger values will be tested against FCSAAP sites ranked in 2003 using SLRA results, to determine the usefulness, practicality and accuracy of ranking using the trigger values.
2004-05	Cantox	Revise and update the soil quality guideline supporting document for dioxins and furans (excluding toxicological review and update).	Health Canada's analysis of PCDD/DF employed a dated TDI of 10 pg/kg-d, a dated toxic equivalency scheme and older data to quantify background EDI. There is a need to revise the supporting document to reflect a revised TDI of 2 pg/kg-d, to employee the recent WHO TEF scheme (if appropriate; including the potential carcinogenicity of 2,3,7,8-TCDD) and to update the EDI to reflect the latest available Canadian data on PCDD/DF levels in foods, air, water and soil.
2004-05	Dillon	Prepare a soil quality guidelines supporting document for chlorinated benzenes.	Chlorinated benzenes (mono, di-, tri-, tetra-) were a group of substances evaluated under the Priority Substance List of the *Canadian Environmental Protection Act*. Health Canada now requires a scientific rationale document to support the development of guidelines for soil and groundwater.
Soil Background (Natural) Levels			
2003-04; 2004-05	Geological Survey of Canada	Development of a publicly accessible, web-based GIS database on background (natural) levels of metals in Canadian soils.	Background soil concentrations of inorganic elements must be considered before soil quality guidelines and risk management plans can be established. GSC is the federal authority on soil geochemistry and was commissioned by Health Canada to assemble federal and provincial data sources into a single database to facilitate easy identification and retrieval of relevant documentation.
Modelling			
2004-05	Sanexen (QC); Levelton (BC); Meridian (AB)	Critical evaluation and/or development of environmental fate models to evaluate chemical fate in soil, groundwater and air when released from contaminated sites and during remedial activities.	Standard Canadian models for use in risk assessment and during the evaluation of remedial plans under CEAA do not exist at present. Health Canada requires the identification and/or development of models that it can recommend support or accept, both to support its roles under FCSAAP and to evaluate remedial plans under CEEA.

FY	Contractor	Project Description	Rationale
2003-04	Angus Environmental	*A Review of Three Factors that Influence Subsurface Vapour Migration into Houses* (Indoor infiltration into electrically-heated homes: are unique assumptions required?)	The modelling of the indoor intrusion of volatile substances from soil and groundwater is based largely on house characteristics and assumptions derived from buildings with forced air heating systems and exhaust flues (chimneys). These flues create stack effects and negative pressure differentials in the lowest storey. Electrically heated homes have no flues and may be less likely to have a stack effect or negative pressure differentials. Determination of suitable assumptions for electrically heated homes was, therefore, required.
2004-05	Water and Earth Sciences Assoc. (WESA)	Compilation and comparison of methods to predict contaminant accumulation from soil into vegetation.	Contaminant uptake into plants used as food is often a critical exposure pathway in contaminated site risk assessment, particularly for residential properties with backyard gardens. Health Canada requires a method that it can apply, support and recommend to predict contaminant uptake from soils into plants used as food.
2004-05	Health Canada-NCR	Review of Environmental Models for Estimating Contaminant Concentrations at Contaminated Sites	Model descriptions have been collected from compilations made by the Organisation for Economic Cooperation and Development (OECD), the Canadian Environmental Modelling Centre (CEMC, Trent University), the US Environmental Protection Agency (US EPA), the US Geological Survey (USGS) and others made by private organisations such as the Batelle Pacific North-West Laboratory and the Chemical Computing Software website. These compilations yielded a total of around 200 different models. In addition, a report prepared for Alberta Environment by MDH Engineering Solutions evaluated approximately 200 groundwater models for suitability in predicting concentrations at sites contaminated with road salt. From these compilations, a total of 164 diverse models were identified for inclusion in a spreadsheet compilation. These models consisted of 52 air dispersion models, 2 air receptor models, 2 indoor air models, 17 surface water models, 24 groundwater models, 10 soil models, 2 sediment models, 28 multimedia models, 2 property estimation models and 19 models with miscellaneous uses. The models are tabulated in an Excel spreadsheet along with available information on model description (i.e., what the model does), regulatory use (if applicable), model outputs, source of model, where model can be obtained, expertise needed to use the model effectively. There is also a column for comments, which will be populated after the selection phase is complete. The spreadsheet will be updated with some of the other models identified if they are found to be significantly different in design and application from those models already in the spreadsheet.

FY	Contractor	Project Description	Rationale
Risk Assessment Methods			
2003-04	Health Canada-NCR	*Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Screening Level Risk Assessment (SLRA)*	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment.
2003-04	Health Canada-NCR	*Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs)*	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment.
2003-04	Wilson Scientific; BEC Technologies; Angus Environmental	Peer review of *Federal Contaminated Site Risk Assessment in Canada, Part I and Part II.*	To confirm the validity and defensibility of Health Canada SLRA guidance, peer review was sought from three well-qualified and practising Canadian risk assessors.
2003-04	Various RA consulting firms	Workshop to review and suggest revisions to Health Canada's SLRA guidance, Parts I and II.	In 2003, 85 federal contaminated sites were submitted to risk assessment following Health Canada's SLRA guidance. The consultants carrying out those risk assessments under contract to federal custodial departments were invited to a workshop to evaluate the effectiveness and defensibility of Health Canada's SLRA guidance, and to suggest recommended revisions.
2003-04	BEC Technologies; Health Canada-NCR	*Federal Contaminated Site Risk Assessment in Canada, Part III: Guidance on Peer Review of Human Health Risk Assessments*	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment.
2003-04	Meridian Environmental	*Federal Contaminated Site Risk Assessment in Canada, Part IV: A Spreadsheet to Conduct Human Health Screening Level Risk Assessment (SLRA)*	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment. The guidance offered in SLRA Parts I and II was committed to spreadsheet format, with Health Canada's preferred equations, assumptions and TRVs, to facilitate rapid screening level risk assessments for federal sites.
2003-04	Golder Associates	Screening level risk assessment guidance on indoor vapour intrusion. (In association with the BC Science Advisory Board on Contaminated Sites.)	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment that reflects the latest scientific advances and understanding of the factors and phenomena that influence indoor intrusion of volatiles.

FY	Contractor	Project Description	Rationale
2004-05	Golder Associates	Create a risk assessment spreadsheet to derive hazard quotients and cancer risk estimates for petroleum hydrocarbon components following the procedures and models recommended by Golder Associates for indoor intrusion SLRA.	Health Canada is required to provide authoritative guidance on the conduct of contaminated site risk assessment that reflects the latest scientific advances and understanding of the factors and phenomena that influence indoor intrusion of volatiles. The guidance recommended by Golder will be committed to spreadsheet format to facilitate rapid screening level risk assessments for federal sites.
2003-04; 2004-05	Meridian Environmental	*Federal Contaminated Site Risk Assessment in Canada, Part V: Site-Specific Risk Assessment for Chemically-Contaminated Sites*	Health Canada is required to provide authoritative guidance on the conduct of complex site-specific risk assessment. Guidance on complex site-specific risk assessment is required for those sites where simple screening level risk assessment is inadequate.
2004-05	SENES (BC)	*Federal Contaminated Site Risk Assessment in Canada, Part VI: Site-Specific Risk Assessment for Radiologically-Contaminated Sites*	Health Canada is required to provide authoritative guidance on the conduct of complex site-specific risk assessment. Guidance on complex site-specific risk assessment is required for those sites where simple screening level risk assessment is inadequate.
2004-05	Cantox (QC)	*Federal Contaminated Site Risk Assessment in Canada, Part VII: Site-Specific Risk Assessment for Microbiologically-Contaminated Sites*	Health Canada is required to provide authoritative guidance on the conduct of complex site-specific risk assessment. Guidance on complex site-specific risk assessment is required for those sites where simple screening level risk assessment is inadequate.
2004-05	Dillon Consulting	Description of Health Canada TRVs, and their comparison to TRVs from EPA, WHO, and other regulatory agencies.	The compilation of Health Canada TRVs (SLRA guidance, Part II) requires additional information concerning the basis of those TRVs and how they compare to TRVs from other agencies.
2003-04	Wilson Scientific	Guidance for Development of Toxicity Reference Values (TRVs) for Federal Contaminated Site Risk Assessments, in the Absence of Published Regulatory TRVs (To be incorporated in Federal Contaminated Site Risk Assessment in Canada, Part V.)	Health Canada is required to provide authoritative guidance on the conduct of complex site-specific risk assessment. Guidance was required on the means of deriving de novo TRVs where neither Health Canada nor other agencies have established a TRV.
2003-04; 2004-05	GlobalTox International	Critical review of the practice of exposure amortization in contaminated sites carcinogen risk assessment.	It is standard practice to amortize (pro-rate; average) less-than-lifetime exposures over total life expectancy prior to estimating cancer risks posed by the less-than-lifetime exposure to carcinogens. However, preliminary evidence suggests this practice may not meet the tenor of the federal 'precautionary principle'.

FY	Contractor	Project Description	Rationale
2003-04	Meridian Environmental	Review of Assumptions and Methods Used in the Development of the Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil	Following federal (Treasury Board) policy directives, Health Canada identifies the CCME CWS PHCs as the means by which risks posed by volatiles should be assessed. However, Health Canada is evaluating the Atlantic RBCA approach as a possible substitute for the CWS PHCs. A critical review of the CWS PHCs is part of the critical comparison of both approaches, required before a decision on the ARBCA approach can be finalized.
2003-04; 2004-05	MGI; Meridian Environmental; Golder Associates; Philips Analytical	Comparison of the Atlantic RBCA approach and the CCME CWS PHC for the assessment and management of petroleum-contaminated sites. (A: Comparison of Tier I and Tier II risk management guidelines and objectives - MGI) (B: Comparison of risk estimates [hazard quotients, cancer risks] using ARBCA [MGI]; CWS PHCs [Meridian]; considering the latest science and understanding of vapour intrusion [Golder]) (C: Comparative evaluation of ARBCA and CWS analytical methods for PHC in soil samples)	Following federal (Treasury Board) policy directives, Health Canada identifies the CCME CWS PHCs as the means by which risks posed by volatiles should be assessed. However, Health Canada is evaluating the Atlantic RBCA approach as a possible substitute for the CWS PHCs. A critical review and comparison of both approaches was required before a decision on the ARBCA approach can be finalized.
2004-05	Meridian	Development of a spreadsheet to conduct human health screening level risk assessments following the CCME Canada Wide Standard for Petroleum Hydrocarbons in Soil	To date, CCME has not released a spreadsheet of other risk assessment tool that makes possible the rapid screening level risk assessment of sites contaminated with PHCs, following the CCME CWS methodology.
2003-04	Dillon Consulting	Comparative Study of Provincial Human Health Risk Assessment Methods for Contaminated Sites	The extent of inter-provincial variability in risk assessment methods and their subsequent risk estimates was required in order to ascertain the need for standardized guidance for assessing and ranking federal sites.
2004-05	Morrow Consulting (BC)	Preparation of human health-based air quality exposure limits for use in rapid evaluations of air-borne exposures.	Health Canada is routinely requested to comment on risks posed by air-borne exposures, whether from stack emissions, air-borne dispersion from contaminated sites, etc. Health Canada requires a compilation of available toxicological tolerable daily intakes, tolerable air concentrations, etc., and acceptable air concentrations derived so that rapid response/reply can be achieved.

FY	Contractor	Project Description	Rationale
2004-05	Meridian	Critical review and recommendation of soil ingestion rates for contaminated site risk assessments in Canada and evaluation and quantification of pica behaviour.	Canadian assumptions regarding soil ingestion rates were established in the early 1990's; recent data should be reviewed and these assumptions updated as the data suggest. Recommendations concerning soil intake due to pica behaviour are also required. Pica behaviour (excessive soil intake) is a sporadic behaviour in some children. The frequency of this behaviour, and the quantities of soil ingestion, must be evaluated to determine suitable assumptions for risk assessments or for guidelines derivation, for circumstances when this behaviour is known to be prevalent or where this behaviour has the potential to create an acute toxic risk.
2004-05	Dillon	Quantitative definition of worker (occupational) exposure scenarios for federal contaminated sites.	Many federal contaminated sites are work sites for federal employees. Also, private sector workers may be exposed to contaminants on federal sites when installing underground services, constructing foundations for buildings/additions, etc. Empirical data needs to identified, compiled and analysed to permit Health Canada to define defensible, realistic exposure scenarios, for use within risk assessments, for these occupational groups when frequenting/occupying federal contaminated sites.
2004-05	Meridian/ Wilson Scientific	Develop guidance on when to apply chronic/ sub-chronic/acute TRVs in contaminated site risk assessment.	At present, Health Canada has not defined chronic versus sub-chronic versus acute exposure durations, for which different TRVs are applicable.
2004-05	Meridian/ Wilson Scientific	Develop guidance on when and how to apply soil ingestion rate assumptions reflecting pica behaviour, both in context of general risk assessment and in the context of the application of chronic/sub-chronic and acute TRVs.	At present, Health Canada has not defined any assumptions regarding soil ingestion rates (g/day) for pica behaviour, nor for the frequency of pica behaviour (days/year), both of which may influence decisions regarding appropriate durations of toxic exposures (chronic versus sub-chronic versus acute).
Training			
2003-04	Health Canada	Introduction to risk assessment and Health Canada's screening level risk assessment guidance. (One day seminars in Halifax, Montreal, Ottawa, Toronto, Edmonton, Vancouver.)	Health Canada is required to provide training in risk assessment procedures to contaminated sites managers and assessors from custodial departments. Proceedings were also open to provincial, territorial and municipal contaminated sites regulators and risk assessors.

FY	Contractor	Project Description	Rationale
2003-04; 2004-05	BEC Technologies	Delivery of training in contaminated sites risk assessment to risk assessors in Health Canada, and to assessors and site managers in other government departments. (Two 2½ day hands-on, computer-based training sessions to be held in each of Halifax, Montreal, Ottawa/Toronto, Edmonton/Calgary, and Vancouver.)	Health Canada is required to provide training in risk assessment procedures to contaminated sites managers and assessors from custodial departments. Proceedings are also open to provincial, territorial and municipal contaminated sites regulators and risk assessors, as space permits.
2004-05	Meridian	Develop curriculum and modules for training in the use of Health Canada's SLRA spreadsheet, and in use of Health Canada's peer review checklist.	Health Canada has developed a spreadsheet version of its SLRA guidance, and has developed a peer review checklist. One day training sessions are required in various regions of the country to inform and instruct federal contaminated sites managers on the use of these tools. (Atl, QC, ON, MB/SK, AB, BC)
Toxicology			
2003-04; 2004-05	GlobalTox International	Critical review and analysis of the toxicology of elemental Hg (Hg vapour), with development of a proposed regulatory reference exposure level (REL).	Numerous federal sites are contaminated with elemental mercury (hydrometric stations; navigational light stations) and no Canadian REL is available for risk assessment purposes.
2004-05	AMEC	Critical, quantitative analysis of factors contributing to the variability and uncertainty in a Canadian reference exposure level for mercury vapour.	The establishment of TRVs or RELs involves the application of uncertainty factors to account for variability in toxic response among individuals, and the completeness of the toxicological database. Also, means of converting differing exposure measurement methods must be considered. Factors to evaluate include: ■ inter-individual variability (review lit and develop probabilistic model of inter-individual variability in urinary Hg levels as a function of air concentration); ■ apply International Programme on Chemical Safety (IPCS) approach to dividing the intra-species UF between pharmacokinetic and pharmacodynamic factors; ■ alternate methods/models for converting urine Hg to air Hg levels (lit review; conversion of µg Hg/L urine to µg Hg/g creatinine; µg Hg/g creatinine to µg Hg/m^3 of air); ■ evaluation of potential gender differences in pharmacokinetics, pharmacodynamics and effects of Hg vapour exposure;

FY	Contractor	Project Description	Rationale
2004-05 (cont'd)	AMEC (cont'd)		■ potential fetal effects of Hg vapour exposure in pregnant women; ■ evaluation of U-NAG as a biomarker for renal effects (type of effects; extent of effects; reversible versus irreversible; other substances with RELs based on similar endpoints); ■ RELs for immunological and neurological end points; ■ documentation and quantification of current Hg vapour exposure in the Canadian environment (lit review; update Richardson 1995 and other pubs; use National Health and Nutrition Examination Survey (NHANES) to back calculate from Urine Hg to air Hg; devise an 'equivalent' Hg air level to which NA population is exposed).
2004-05	Canadian Coast Guard	Re-evaluation of the toxicity of lead (Pb) and development of a human health-based management strategy for Canadian Coast Guard's (CCG) manned light stations on the Pacific coast.	The single largest concern at manned light stations located on the Pacific and Atlantic coasts is lead (Pb) contamination from the use of lead-contaminated paints. Health Canada is supporting the re-evaluation of Pb exposure and toxicity specifically as it relates to contaminated soils, and development of a Pb-contaminated soils management plan for CCG manned light stations.
2004-05	INSPQ (Quebec)	Re-evaluation of the toxicity of PCBs, towards revising the Canadian toxicological reference value for this substance.	The Canadian evaluation of this substance is greatly out of date (1986) and fails to address the potential carcinogenic effects, and does not address the different PCB congeners (co-planar or other). Revision of this TRV is of interest to contaminated sites but also to the Foods Directorate and other groups within Health Canada. Environmental Health Assessment Services of Health Canada is leading the review of PCBs by initiating a critical review of toxicological studies.
2004-05	Equilibrium Environmental	Critical review of the toxicology and TRV(s) for C_6 to C_{10} petroleum hydrocarbons (CCME's PHC F1 fraction).	Recently published toxicological studies on low molecular weight PHCs, and revised TRVs from the US EPA necessitate a re-evaluation of TRVs used to establish the Canada-Wide Standards for F1 PHCs in soil, published by the CCME. This project also relates to the on-going evaluation of the CWS PHCs and the ARBCA approaches for petroleum hydrocarbons.
2004-05	URS (BC)	Critical review of the toxicology and TRV(s) for petroleum hydrocarbons encompassing CCME's PHC F2, F3 and F4 fractions.	Recently published toxicological studies on various PHC substances, and revised TRVs from the US EPA necessitate a re-evaluation of TRVs used to establish the Canada-Wide Standards for F2, F3 and F4 PHCs in soil, published by the CCME. This project also relates to the on-going evaluation of the CWS PHCs and the ARBCA approaches for petroleum hydrocarbons.

FY	Contractor	Project Description	Rationale
2004-05	Mutagenisis Section, Safe Environments Programme, Health Canada (Paul White)	*In vitro* genotoxicity studies of mixtures of substances in soil from contaminated sites, and analysis for additivity/ synergism/antagonism of contaminant mixtures.	Contaminated sites present mixtures of substances, not single chemical or element exposures. One of the most asked questions to Health Canada is how to assess mixtures within a contaminated site risk assessment. Research and investigation is required to provide the necessary scientific basis for sound risk assessment advice on mixtures to other government departments.
2004-05 to 2006-07	Systemic Toxicology and Pharmaco-kinetics Section, Safe Environments Programme, Health Canada (Wayne J. Bowers)	Developmental rodent bioassay employing a mixture of 5 inorganic elements commonly occurring at federal contaminated sites.	Human health-based soil quality guidelines are derived on a chemical-by-chemical basis, omitting consideration of combined effects of mixtures that may be synergistic (more than additive) or antagonistic (less than additive). However, substance exposures seldom if ever occur singly. Therefore, a bioassay is required to determine the protection offered by soil quality guidelines when exposure occurs to a common mixture of substances occurs. Developmental effects were selected as the endpoint due to the potential sensitivity of the foetus to toxic effects.
2004-05	GlobalTox International	Critical review of existing approaches for assessing risks posed by chemical mixtures.	At the present time, it is believed to be general practice to assume that the effects of multiple chemical exposures are additive where they impact the same target organ and/or cause similar effects. However, there is little substantive science to support this practice. A review of practices within Canada (Health Canada, EC, provinces, etc.) and internationally (US EPA, WHO, IPCS, etc.) is required as a first step to establishing a best practice for application to federal contaminated sites. This project is the first of two parts. Once current practice on mixtures risk assessment is reviewed, a second project will be initiated to review the empirical evidence for as many mixtures as possible to ascertain the prevalence of effects being additive, less than additive, or more than additive.
2004-05	Globaltox	Literature review and selection of the key study or studies for development of a dermal slope factor for PAHs.	Much of the toxicological equivalency factors established for carcinogenic PAHs are based on the relative carcinogenicity of dermally applied PAHs. However, although dermal exposure is a significant exposure pathway for PAH and dermal exposures cause skin cancer, only oral and inhalation slope factors have ever been derived.
2004-05	Cantox	Critical review of the inhalation toxicity of trichloroethylene (TCE), with recommendations as to appropriate TRV for inhalation exposures.	TCE is carcinogenic via inhalation, and Health Canada established a dose-response relationship in 1996 from which an inhalation slope factor was derived. However, studies since 1996 suggest that TCE may be a more potent inhalation carcinogen that previously determined, requiring revision of the inhalation slope factor.

FY	Contractor	Project Description	Rationale
2004-05	Cantox	Critical review of the toxicology of perchlorate.	Perchlorate is emerging as a major and pervasive contaminant of groundwater in the U.S., and a small recent survey in Canada indicates its presence in some ground waters at low levels. A detailed and critical review of the human and mammalian toxicology of perchlorate is required as input to the development of a scientific rationale document to support the development of soil and water quality guidelines.
2004-05	Fabien Gagnon (QC) (INSPQ; U. Laval)	Review of the potential link between perchlorate exposure (and other substances) and the occurrence of hyperthyroidism in the Quebec population.	An ongoing project on the incidence of hyperthyroidism in Quebec is being expanded to specifically include perchlorate, due to the presence of this substance at various contaminated sites locations in that province.
2004-05	Cantox	Critical review of the toxicology of 1,4-dioxane.	1,4-dioxane is emerging as a contaminant of groundwater at certain federal sites containing chlorinated solvents. A detailed and critical review of the human and mammalian toxicology of 1,4-dioxane is required as input to the development of a scientific rationale document to support the development of soil and water quality guidelines.
Bioavailability			
2003-04; 2004-05	Jacques Whitford	Compilation of a database on published and grey literature data concerning the oral bioavailability of arsenic (As), lead (Pb) and cadmium (Cd) from contaminated soils.	Bioavailability may be used for more accurate site-specific assessments of exposure and risk from contaminated soils. However, the factors that influence measures of bioaccessibility and bioavailability are not fully understood. There is a need to compile existing data and conduct meta-analyses.
2003-04; 2004-05	Royal Roads University; UMA	Investigation of the influence of soil particle size and gastric fluid volume to soil mass ratios on measured bioaccessibility. (Literature review - UMA; Laboratory investigations - RRU.)	Adjustment for site-specific oral bioavailability will increase the accuracy and validity of contaminated site risk assessment. However, no Canadian agency has yet defined standard methods for measuring this variable. Current methods available in the literature are inadequate for accurately quantifying this parameter. Work will ultimately contribute to development of *Federal Contaminated Site Risk Assessment in Canada, Part VIII: Standard Methods for Conducting Assays of Contaminant Bioaccessibility for Federal Contaminated Sites in Canada.*

FY	Contractor	Project Description	Rationale
2004-05	Canadian Centres for Toxicology/ University of Guelph	Investigation of the influence of metals mixtures on the bioavailability/ bioaccessibility of individual metals from soil.	It is postulated that the bioaccessibility or bioavailability of any given metal within a mixture of metals in soil will be less than the solubility of that same metal when present in soil alone. This hypothesis requires investigation before Health Canada can develop guidance on the conduct and interpretation of bioaccessibility/bioavailability studies for federal contaminated sites. Work will ultimately contribute to development of *Federal Contaminated Site Risk Assessment in Canada, Part VIII: Standard Methods for Conducting Assays of Contaminant Bioaccessibility for Federal Contaminated Sites in Canada*.
2004-05	UMA/Wilson Scientific	*Critical Review of the Application, Methods and Interpretation of Lung Fluid Solubility Assays in Risk Assessment*	Wind erosion, remedial excavation, agricultural activities, vehicular traffic on unpaved contaminated surfaces, etc. can result in significant air-borne loads of contaminated soil particles, the inhalation of which can lead to exposure to particle-borne contaminants. For substances absorbed systemically from the lungs, it may be appropriate to account for their respiratory bioavailability when estimating systemic dose and subsequent risks. A critical literature review of the application, methods and interpretation of *in vitro* methods of measuring respiratory bioavailability is required prior to determining the need for such adjustment.
2004-05	Meridian	Survey and review of standard practices in Canadian analytical laboratories for soil sample preparation and extraction/digestion; literature review on bioavailability of organic substances from soil.	Studies of bioavailability and bioaccessibility are becoming increasingly used to adjust for contaminant uptake on a site-specific basis. However, there has been no review comparing studies of bioaccessibility or bioavailability to the standard methods used for sample digestion and extraction, to determine if current analytical methods are or are not measuring what is bioavailable. A review of bioavailability/ bioaccessibility studies published on organics is also required.
2004-05	Environmental and Occupational Toxicology Division (Health Canada)	*In vitro* assays of dermal penetration of soil-borne organic and inorganic contaminants through viable human skin.	Adjustment for differential dermal bioavailability is standard practice for contaminated site risk assessment. However, available dermal absorption factors are seldom based on studies of soil-borne contaminants. Also, little or no dermal bioavailability data for contaminants at federal contaminated sites is based on investigations using viable human skin.

FY	Contractor	Project Description	Rationale
2004-05	AMEC	Review of Health Canada Toxicology Studies, Reports and Provision of Bioavailability and Background Daily Intake Values.	In order to ascertain *relative* oral bioavailability for soil-borne contaminants, measured bioavailability must be considered relative to the bioavailability for the same substance in the study employed to establish the TRV. Also, risk assessments are more accurate if total exposures - site + background - are determined for comparison to appropriate TRVs. The compiled information will be included in the revisions to *Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs).*
Remedial Technologies			
2003-04; 2004-05	SAIC	Evaluation of the health risks associated with different contaminated soil remedial technologies.	Under the *Canadian Environmental Assessment Act*, custodial departments need to undertake an environmental assessment for their planned remediation activities. This document is intended to facilitate the review of remedial plans and the identification of health impacts and/or risks from the different remedial technologies.
Miscellaneous			
2003-04	Statistics Canada	Create maps depicting federal contaminated sites in Canada and their proximity to populated areas.	Risks posed by contaminated sites are, in part, related to the number of Canadians potentially exposed. Statistics Canada was commissioned by Health Canada to prepare maps of federal sites listed in Treasury Board's Federal Contaminated Sites Inventory (as of June 2003), identifying those sites within 0.5 km, 1.0 km, 2.0 km and 5.0 km of populated areas.
2003-04	Hardy Stevenson	Development of a guidance document on public outreach at contaminated sites.	Health Canada is required to provide guidance on when and how to use public outreach at federal contaminated sites.
2004-05	Franz Environmental	Review and analysis of the frequency of occurrence of various mixtures of contaminants at federal contaminated sites in Canada.	As part of a broader investigation of mixtures and how to approach risk assessment for mixtures, Health Canada requires an analysis of federal contaminated sites to determine what actual mixtures of substances occur with the greatest frequency.
2004-05	Meridian	Review and comparison of analytical methods to measure contaminants in soil samples.	It is unknown if all environmental analytical laboratories in Canada employ the same method(s) for sample work-up and extraction/digestion. This can have significant influence on the measured concentration of contaminants in soil samples. A survey and review of current practices in Canadian labs is required.

FY	Contractor	Project Description	Rationale
2004-05	Canadian Centres for Toxicology, U. of Guelph, ON	Stakeholder consultation (workshop)	Health Canada's CSD has initiated numerous projects that have the potential for significantly influencing how contaminated sites risk assessment will be conducted for federal sites, and that could influence how the provinces/territories want risk assessments conducted. It would be appropriate to initiate consultations with industries and other groups that could be affected by Health Canada's methods and studies.
2004-05	Environmental and Occupational Toxicology Division (Health Canada)	Analysis of total organic carbon in house dust. Analysis of mercury in environmental samples (plants, soil, foods, biota, etc.).	Bioaccessibility of inorganic contaminants from soil increases as TOC increases in samples. House dust is another source of metals exposure, and preliminary data on TOC levels in house dust indicates TOC levels about 10 times that found in soils. Confirmation of this is required. Mercury is a high priority issue for Health Canada. The capability for rapid, high quality analytical capability must be established to support the CSD.
2004-05	Globaltox	Develop a streamlined ranking scheme for FCSAAP ranking of federal sites with environmental liabilities (remedial costs) less than $250K.	The FCSAAP is being expanded to include federal sites with remedial costs less than $250K. Human and ecological SLRA costs approx. $20K to complete. For low cost sites, this is a disproportionate expense relative to their remedial costs. Therefore, a simplified, streamlined ranking scheme is required to these low cost sites.
2004-05	Globaltox	Critical review of the particle size range(s) that adheres to skin and is most predominantly associated with dermal exposure to contaminants adsorbed to soil particles.	No guidance currently exists in Canada that defines the critical particle size fraction that adheres to children's skin and will result in dermal absorption of soil-borne contaminants. However, existing literature suggests that the critical size fraction is < 10 µm. This size fraction is also associated with general greater contaminant concentrations than bulk soil (due to greater surface area for adsorption) and greater bioavailability than from bulk soil. A thorough and critical review of existing literature is required to resolve this issue.
2004-05	Cantox	Probabilistic determination of estimated background daily intakes (EDIs) for up to 5 inorganic contaminants found at federal contaminated sites.	Estimated (background) daily intakes (EDIs) are an integral component of the guidelines derivation process, being subtracted from the TRV prior to guidelines derivation. Currently, only point (deterministic) estimates for average or typical background exposures are used. The application of probabilistic methods to deriving EDIs will significantly improve their statistical and scientific defensibility, and better reflect background exposures across the Canadian population.

ANNEX 3: LIST OF PROJECTS REVIEWED UNDER THE FCSAAP IN 2004-2005

Health Canada Technical Review Committee 2004-2005 Contaminated Sites (April 1, 2004 to March 31, 2005)
Project Name
Goose Bay (Newfoundland) DND
Riding Mountain Operations Compound (Manitoba) PCA
Kingfisher Lake First Nation (Ontario) INAC
Northland Denesuline First Nation – Former School Tank Farm (Manitoba) INAC
Former Nitchequon MeterologicalMeteorological Station (Quebec) TC
Roberts Bay – Roberts Bay Silver Mine and Ida Bay Silver Deposit INAC
Red Bridge Spur (British Columbia) PWGSC
Bushell Public Port Facility (location) PWGSC
Red Sucker lake First Nation – Former School Tank Farm (Manitoba) INAC
Bowden Correctional Institution (Alberta) CAC
Berens River First Nation (Manitoba) INAC
Berens River First Nation/Brochet – Frontier School (File #04-J-381) (MB) INAC
Gods Lake First Nation – Band Tank Farm (File #04-J-338) (MB) INAC
Gods Lake First Nation – Old School Petroleum Storage (File #04-J-330) INAC
Weeneebayko Hospital, Moose Factory (ON) Health Canada
CFB Esquimalt – Ship Repair Zone (DY-4) (BC) DND
Mathias Colomb Cree Nation – Old Nursing Station (MB) INAC
Atlantic Institution – Site 001 – (New Brunswick) CAC
Port of Pleasant Camp (BC) CBSA
Mary Anne Falls Landfill, Cape Breton Highlands National Park (NS) PCA

ANNEX 4: LIST OF SCIENCE INITIATIVES PROPOSED FOR 2005-2006

Proposed Studies and Projects to be Considered by Health Canada for Fiscal Year 2005-06		
Description	**Rationale**	**Estimated Cost**
Critical review of Raoult's Law and its application to PHC risk assessment.	Raoult's Law states that the solubility of one substance within a mixture is depressed as a result of the presence of other substances in that mixture. A review is required to formulate specific hypotheses for bench scale research.	$25K
Laboratory studies to quantify parameters for application of Raoult's Law to petroleum hydrocarbon mixtures.	Raoult's Law states that the solubility of one substance within a mixture is depressed as a result of the presence of other substances in that mixture. Following a thorough literature review, hypotheses will be tested to provide quantified parameters or coefficients to allow the application of Raoult's Law to environmental fate and exposure modeling of PHCs.	$25K
Investigate and quantify seasonal temperature variations in the subsurface environment, for correction of Henry's Law Constant as applied to modeling indoor intrusion of PHC vapours.	Correcting H for seasonal temperature variations can have a significant influence on predictions of indoor infiltration of volatile PHCs. Investigation is required of the seasonal temperature range fluctuations in the subsurface soil environment in different regions of Canada, to ensure that temperature corrections of H reflect the actual extent of temperature fluctuations observed.	$25K
Development of a standard method to collect soil particles of ≤10 µm.	The primary soil particle size fraction that is ingested is ≤10 µm. Current soil sampling methods investigate only bulk soil samples generally ≤250 µm (60 mesh sieve). A standard, easy to conduct method of collecting the ≤10 µm size fraction is required to enable chemical analysis of size specific soil samples (contaminant concentration) and assays of bioaccessibility for this size fraction.	$50K
Obtain and statistically analyse recent Canadian food consumption survey data.	Health Canada wants to release the 2nd edition of the *Compendium of Canadian Human Exposure Factors for Risk Assessment*. The first edition is now the primary source of information on human receptor characteristics for Canadian contaminated sites risk assessments. Data on recent (1990-2002) food consumption surveys is held by the Food Directorate and its inclusion in the *Compendium* is desirable.	$25K
Establishing improved receptor characteristics for Canada's First Nations communities.	Assumptions concerning soil ingestion and food intakes require revision and updating to better reflect the nature of FN food consumption patterns and contact with soils for ingestion and dermal exposure.	$25K

Description	Rationale	Estimated Cost
Application and comparison of the vapour intrusion risk assessment methods encompassed by Atlantic RBCA, the CCME CWS PHC, and the 'Golder' guidance for application to non-PHC volatile organics, such as chlorinate organic solvents. (MGI – ARBCA; Meridian – CWS PHCs approach; Golder – Golder guidance.)	There is a need for Health Canada to develop and/or select appropriate procedures for evaluating the risks posed by the potential indoor intrusion of soil-borne or groundwater-borne volatile organics other that those PHCs. Three existing Canadian approaches developed for PHCs will be tested and compared for their applicability to non-PHC contaminants.	$25K
Review of the appropriateness of the use of the arbitrary default values to ascribe the allowable proportion of total chemical exposure to the five primary media (i.e., 20% for soil, consumer products, air, water, food).	The allowable contaminant apportionment to the five primary media (i.e., soil. consumer products, air, water, and food) is based on an arbitrary default value of 20%. Thus, a default value of 20% of the residual acceptable daily intake is apportioned to each of these five media. As a result, the soil allocation factor of 20% is used to derive soil remediation guidelines, allowing for 80% of the remaining tolerable incremental exposure to be reserved for other media. The only alternative to this approach is to demonstrate that the contaminant does not occur in a given media and redistributes the RTDI amongst fewer media (i.e., SF = 100%/[number of applicable media]). Are the arbitrary 20% apportionment and the alternative reapportionment method appropriate or are other more scientifically defensible approaches available?	$25K
What is the role of acute exposures at contaminated sites? A review of the literature, possible development of an acute toxicity database.	Are chronic exposures and toxicity always driving the remediation or management of a contaminated site? Are there instances when acute exposures should be driving the remediation? Currently, some risk assessors are inflating chronic exposure limits by 10 to address short-term exposures. A review of the literature to compile acute oral/inhalation exposure limits to complement the existing chronic TRVs developed by Health Canada, the development of a toxicity database to document short-term exposures, a review of the scientific literature for findings with respect to short-term exposures at contaminated sites (this could also be relevant for children and short-term exposures). In the future a guidance document could be developed relating to short-term exposures at contaminated sites (or incorporated into existing guidance).	$25-50K
Review of the literature surrounding exposure and health risks specific to children.	A review of the current research with respect to exposure limits, exposure, and health risks as related to children should be undertaken. Particular chemicals that may pose a higher risk to children should be identified and prioritized. This could lead to the development of a guidance document on assessing exposures and health risks specific to children.	$15K

Description	Rationale	Estimated Cost
Is there a connection between odour and potential health impacts at contaminated sites?	A literature review of odour and potential health impacts. Potential ramifications to risk assessment of contaminated sites should be evaluated. Currently, odour impacts are not assessed from a health perspective, or any potential health impacts are thought to be transitory in nature.	$15-20K
Incorporate research and contract reports from 2003-04 and 2004-05 into revisions of Health Canada's risk assessment guidance documents.	Numerous research and contract reports conducted in FY 2003-04 and 2004-05 are completed (or nearing completion) and must be incorporated into guidance documents published by Health Canada.	To be determined
Guidance on soil sampling and locating and installing groundwater and soil vapour monitoring wells.	At present HC has no guidance on contaminated site-sampling strategies. Some minimal guidance is required to ensure that the data collected at contaminated sites is, to the degree possible, representative and directly relevant and to the assessment of human health risks.	$50K
Guidance on the critical review of toxicological studies and selection of the key study(ies) for establishing TDIs.	When setting a 'provisional source guidance value for groundwater', to conduct the groundwater check to ensure that soil guidelines won't contaminate potable groundwater, guidance is required to ensure that contractors conduct a reasonably critical effort to identify and select the most appropriate key study, in a manner consistent with the manner employed by the Water Quality and Health Bureau (WQHB).	$15K
Editing, translation and publication of the guidance document: An approach to identify and mitigate potential health impacts associated with contaminated sites remediation technologies.	The remediation of a federal contaminated land is subject to the requirements and provisions of CEAA. Therefore, at the request of a federal authority Health Canada must provide expert advice on the health impacts associated with the planned remediation activities, including the remediation technologies used on-site. A guidance document has been developed to help environmental assessment practitioners to identify health impacts associated with remediation activities and propose mitigation measures.	$35K
Editing, translation and publication of Public Involvement guidance documentation.	Health Canada is required to provide guidance to custodial departments on Public Involvement in federal contaminated sites issues.	$15K
Editing, translation and publication of Guidance Document on using a community capacity approach to address psycho-social factors in the assessment of impacts to communities potentially impacted by contaminated sites or remedial activities.	Health Canada is required to provide guidance to custodial departments on Public Involvement in federal contaminated sites issues.	$25K

Description	Rationale	Estimated Cost
Continue the rodent developmental toxicology bioassay of a mixture of metals found at federal contaminated sites (Wayne Bowers, Environmental Health Science Bureau [EHSB]).	Human health-based soil quality guidelines are derived on a chemical-by-chemical basis, omitting consideration of combined effects of mixtures that may be synergistic (more than additive) or antagonistic (less than additive). However, substance exposures seldom if ever occur singly. Therefore, a bioassay is required to determine the protection offered by soil quality guidelines when exposure occurs to a common mixture of substances occurs. Developmental effects were selected as the endpoint due to the potential sensitivity of the fetusfoetus to toxic effects. Work initiated in 2004-05 should continue, toward evaluating the developmental effects of a mixture of metals frequently occurring at federal contaminated sites in Canada.	$227K
Continue to investigate the *in vitro* genotoxicity of soils containing complex mixtures collected from contaminated sites (Paul White, EHSB).	Contaminated sites present mixtures of substances, not single chemical or element exposures. One of the most asked questions to Health Canada is how to assess mixtures within a contaminated site risk assessment. Research and investigation is required to provide the necessary scientific basis for sound risk assessment advice on mixtures to other government departments. Support for work initiated in 2004-05 to investigate the genotoxicity of mixtures of contaminants in soils from contaminated sites will continue in 2005-06. If feasible, samples of soils from federal sites undergoing bioremediation will be collected and forwarded to Paul White (EHSB, Health Canada) for testing.	$50K
Rodent bioassays of PHC fractions F1, F2, F3 and F4.	The TDIs for hydrocarbon fractions are based on surrogate substances, not on the toxicity of the mixtures/fractions themselves. In order to confirm the adequacy of surrogate TDIs and/or to establish fraction-specific TDIs, Health Canada requires toxicity studies of those fractions.	$400K
Peer review of the document supporting a Health Canada REL for mercury vapour.	Once a final supporting document for the Hg vapour REL is completed, peer review will be required.	3 peer reviewers; $5K to $10K per review
A review on the use of physiologically based toxicokinetic models to minimize uncertainties in exposure assessment.	The risk assessment process integrates hazard assessment data on chemical toxicity with exposure assessment information. Toxicokinetic models are useful to support extrapolations outside the range of toxicity testing conditions examined in experimental animals. The basis of toxicokinetic model extrapolation is the assumption that an equivalent "tissue dose" has the same biological effect regardless of the exposure route or the animal species. In other words, physiologically based toxicokinetic models are useful tools for dose, species, exposure route and exposure scenario extrapolations in the risk assessment process.	$25K
A review of current models used to develop cancer slope factors.	Investigation of the linearized multistage model vs. other cancer models (primarily the benchmark dose multistage model for cancer assessment). Is one model better than the other, or is it chemical dependent, etc.?	$25K
Evaluation of the 'life expectancy' (duration of efficacy) for different remedial technologies.	When contaminated sites are remediated, the selected technology is generally based on a combination of risk reduction and cost. However, the duration of efficacy, whether perhaps 5 years, 50 years or 500 years, is not currently taken into consideration when selecting remedial options.	$25K

Description	Rationale	Estimated Cost
Review the health concerns of bioremediation and determine strategies for risk assessment of bioremediation activities.	Bioremediation may be an important technology applied for the remediation/management of federal contaminated sites. Bioremediation may introduce new or unique microbial consortia, or modify the environment to encourage the growth of existing consortia that occur naturally at very low frequencies. Therefore, some review of potential health concerns and formulation of risk assessment methods (such as for EIAs under CEAA) are required.	$25K
Updating and/or formulation of new supporting documents to support health-based soil quality guidelines for substances for which Health Canada has TRVs.	Health Canada has a continuing need to establish health-based soil quality guidelines.	$10K to $25K per substance
Soil quality guidelines for radionuclides.	Numerous federal sites are contaminated with radionuclides. Human health-based soil quality guidelines are required to complement existing drinking water quality guidelines for these radioactive elements.	$25K
Revised soil quality guidelines for arsenic.	Numerous federal sites are contaminated with arsenic. An update of the 1999 human health-based soil quality guideline is required, incorporating the new scientific information available in the literature.	$25K
Delivery of training on public outreach at federal contaminated sites.	Health Canada is required to provide training in public outreach to contaminated sites managers and assessors from custodial departments.	8 programs; Health Canada in-house delivery; $100K
Probabilistic HHRA training in Winnipeg and Ottawa.	The training session originally scheduled for Winnipeg in Feb/05 was postponed owing to year end fund management considerations. This training must be rescheduled to the first quarter of the 2005-06 fiscal year. Numerous requests have been made to offer this same training in Ottawa. Ottawa was not selected as a course delivery location in FY 2004-05.	$50K
Training in the use of Health Canada's SLRA spreadsheet and in the peer review of risk assessments.	Health Canada has developed a spreadsheet version of its SLRA guidance. One day training sessions are required in various regions of the country to inform and instruct federal contaminated sites managers on its availability and use. Training materials are currently under development. (Atl, QC, ON [Toronto], National Capital Region, MB/SK, AB, BC)	$45K ($5K per city + travel and accommodation expenses)
Development of an E-learning tool to promote and enable on-line risk assessment training and education for custodial departments and others interested in the contaminated site risk assessment methods and procedures of Health Canada.	Health Canada is mandated to provide training to custodial departments on contaminated sites risk assessment. An on-line E-learning tool, tailored to Health Canada's guidance and procedures will maximize access to training.	$50K

Description	Rationale	Estimated Cost
Training and guidance on how to prepare a statement of work for a contract to undertake a contaminated site risk assessment.	Numerous custodial department contaminated site managers have requested assistance in preparing statements of work for contracts to undertake valid and defensible contaminated site risk assessments.	$25K
Deliver an introductory (primer) course on how to communicate environmental risks.	Proper and effective risk communications is the hallmark of an effective public involvement program. Staff of Health Canada and of custodial departments requires training in risk communications. Course to be delivered in multiple locations (NCR, regions).	$100K
Establish a database of stakeholders for future public involvement activities and stakeholder consultations.	A standardized database of stakeholders is required to ensure consistent and effective linkages on contaminated sites consultations, public involvement and communications of relevant information.	$10K
Survey of available e-learning (distance learning) programs for risk assessment and related subjects.	An e-learning program on contaminated sites risk assessment, public involvement and EIA for contaminated sites would increase access to training materials. However, a survey is required to first ascertain the success of delivering science-based training via the internet.	$10K
Deliver an introductory seminar (or other mean to reach stakeholders) on how to better identify health impacts in an environmental assessment (under CEAA) conducted for a remediation activity and how to identify adequate mitigation measures.	Federal site remedial projects are subject to the requirements and provisions of the *CEA Act*. However, many custodial site managers are unaware of the requirements, and how to conduct EIAs under the *CEA Act*. The course will introduce participants to Health Canada's guidance: An approach to identify and mitigate potential health impacts associated with contaminated sites remediation technologies.	$25K 7 half-day seminars, in-house
Deliver risk assessment training to Canadian environmental consultants.	To date, Health Canada's training program has been targeted at site managers for custodial departments. However, most risk assessments are conducted under contract by environmental consultants. Therefore, a means is needed of delivering training in Health Canada's risk assessment guidance and requirements.	To be determined
Deliver risk assessment information to the Canadian public, as requested.	To date, Health Canada's training program has been targeted at site managers for custodial departments. A means is needed of delivering a presentation on risk assessment for the layperson or other interested stakeholders.	In-house ($10K for travel)
Conduct a science workshop on Health Canada's risk assessment guidance, science investigations and research.	To ensure that risk assessments are conducted following the most recent methods and incorporate the most recent research, a workshop should be held in order to transfer that knowledge to the private sector (industry, consultants, etc.).	To be determined
Stakeholder consultations on revisions of the CWS PHC, ARBCA and adoption/ adaptation of the Golder guidance on indoor intrusion of volatiles.	Prior to Health Canada prescribing specific guidance on indoor intrusion modelling for volatiles in groundwater and soil, consultations must be conducted. These consultations will be undertaken in concert with: a) the planned review of the CWS by CCME; b) review of the ARBCA by PIRI; and c) the finalization of indoor intrusion modelling guidance by the BC Science Advisory Board for Contaminated Sites.	$25K

Description	Rationale	Estimated Cost
Continued research on the oral bioavailability of soil-borne metals (University of Guelph).	In 2004-05, the Metals in the Human Environment (MITHE) research network was established to investigate various aspect of human exposure to metals, including their oral bioavailability from soil. Health Canada will support the U of Guelph in further research on this topic that will aid Health Canada in better quantifying oral bioavailability in risk assessments.	$25K
Conduct *in vitro* investigations of the dermal bioavailability of uranium.	Uranium is a soil contaminant of high priority at former and existing uranium mines, at low level disposal areas such as Port Hope, ON, and in peace keeping and combat zones to Canadian Forces (and other nations' military) personnel as a result of the use of depleted uranium in munitions. Dermal exposure and uptake is a critical pathway for exposure, but there is virtually no data on the dermal penetration of the common forms of uranium that contaminate soil.	To be determined
In vitro investigations of the dermal bioavailability of other metals and organics through viable human skin (Rick Moody, ESB).	Dermal exposure to contaminants is among the poorest quantified exposure route due to a lack of data on the dermal penetration of contaminants through human skin. Work on this issue started by ESB in 2004-05 should continue, toward developing a database on dermal bioavailability of soil-borne contaminants.	$100K
Hold a workshop of Canadian researchers investigating bioavailability.	There are 10 Canadian academic and private sector researchers investigating and/or conducting bioavailability/bioaccessibility studies on contaminated in soil. There is a need to establish a Canadian working group on bioavailability to coordinate these efforts and to establish complimentary work plans, and to establish short and medium term priorities for research.	$35K
Conduct a round robin of assays of bioaccessibility involving all Canadian laboratories and researchers conducting such assays.	In order to evaluate the inter-laboratory and inter-methodology variability in measures of bioaccessibility of contaminants in soil, a round robin will be initiated using standard reference material soils, and soils collected from an anonymous contaminated site. Contaminants to be determined, but should include both organic and inorganic contaminants.	$50K
Compilation of a database on all published and grey literature data concerning the oral bioavailability from contaminated soil of Ni and/or other inorganic and organic substances (excluding Pb, As, Cd).	Bioavailability data is required for more accurate site-specific assessments of exposure and risk from contaminated soils. There is no single database at present that presents all published data and information on this topic.	$25K
Create a Soil Quality Index, analogous to the Sediment Quality Index, for use in screening federal sites contaminated with mixtures.	A simpler means of categorizing federal sites into high, moderate and low risk categories is required, particularly a scheme with increased ease of understanding for the general public.	$50K

Description	Rationale	Estimated Cost
Investigation of the potential bioaccumulation of perchlorate into leafy vegetables.	Based on data for tobacco plants, and from other observations, it appears that perchlorate bioaccumulates into leafy vegetables. Accumulation likely arises from contaminated irrigation water rather than from contaminated soil, due to perchlorate's relatively high solubility. Greenhouse studies are required to quantify the extent of perchlorate bioaccumulation potential in leafy produce (such as lettuce), for modeling within risk assessments for various regions and sites across Canada where direct measurement of backyard produce or agricultural produce has not been conducted.	$25K
Quantification of the levels of organic carbon and mercury found in indoor dust (Pat Rasmussen, ESB).	Health Canada established an analytical capability to measure TOC and Hg in indoor dusts (soils, and other media) in 2004-05. In 2005-06, samples of dust collected from homes in Ottawa, ON will be analyzed for their content of TOC and Hg.	$55K
Investigation of PCBs from paint in the food chain.	DEW line sites in northern Canada were painted with paints containing high levels of PCBs as a paint elasticiser. The most economic clean up solution is to bury the painted building debris on site, but there is no experimental information on the rate of leaching from paint or uptake into plants, etc.	$25K
Survey of contaminant levels in indoor dust of Canadian homes.	Indoor dust represents a potentially significant source of dermal and ingestion exposure to both inorganic and organic contaminants, particularly for infants and small children. For contaminated site risk assessment, indoor dust levels of contaminants are generally assumed to be 0.3 to 0.4 times that found in outdoor soils. However, levels of inorganics in indoor dust have been found to be 4 to 5 times greater than levels in soils near homes in Ottawa, ON. Indoor dust is considered the single greatest source of exposure to PBDEs. In order to ascertain more precisely the background daily intake of numerous organics and inorganics from this source, a survey of indoor dust from up to 50 homes per city in up to 5 cities in Canada should be undertaken.	$300K ($45K per city for sample and data collection; $75K for analytical services)
The development of a database containing background concentrations of chemicals found in soil, water, garden produce, wildlife game, and traditional food collected from the literature and the many Environmental Impact Assessments completed for the oil sands region of Alberta (e.g., metals, PAHs and VOCs).	Currently, there are no single sources or database in which risk assessors can access to incorporate background chemical concentrations into their multi-media exposure calculations (…from the oil sands region of Alberta). Once the information is consolidated, data gaps can be identified and new studies proposed.	$25K
Will climate change affect contaminated sites in the Northwest Territories?	Permafrost is a thermal condition – its formation, persistence or disappearance is highly dependent on climate. Its distribution, temperature and thickness respond to natural environmental changes and anthropogenic disturbances that cause an alteration to the ground thermal regime. The interaction between climate above the ground and climate below the ground is complex, and dependent on several factors, many of which are affected by climate change. A study is needed to assess the possible effects of climate change on contaminated sites in the NWT.	$25K

Description	Rationale	Estimated Cost
Review of the relevance and utility of epidemiology to the assessment of risks posed by federal contaminated sites.	The cornerstone of contaminated sites risk assessment is the quantification of potential health risks. However, contaminated site risk assessment almost always lacks evidence of a direct link between exposure and health effects, and direct evidence of the resolution of those effects through risk management is also almost always lacking. There are numerous limiations to the application of epidemiology to individual contaminated sites (small sample size, uncertain or improbable actual exposures, etc.). However, a review may be worthwhile to ensure that useful information or approaches are not being overlooked.	$25K