Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Regional Manager/Real Property Contracting/PWGSC
Ontario Region, Tendering Office
12th Floor, 4900 Yonge Street
Toronto, Ontario
M2N 6A6
Ontario

REQUEST FOR PROPOSAL
DEMANDE DE PROPOSITION

Proposal To: Public Works and Government Services Canada

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

Proposition aux: Travaux Publics et Services Gouvernementaux Canada

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

Comments - Commentaires

Issuing Office - Bureau de distribution

Regional Manager/Real Property Contracting/PWGSC
Ontario Region, Tendering Office
12th Floor, 4900 Yonge Street
Toronto, Ontario
M2N 6A6
Ontario

Title - Sujet
RR Stg 1 Construction Eng. Services

Solicitation No. - N° de l'invitation	**Date**
EQ754-141656/A	2013-12-10

Client Reference No. - N° de référence du client
R.050927.001

GETS Reference No. - N° de référence de SEAG
PW-$PWL-023-1903

File No. - N° de dossier	**CCC No./N° CCC - FMS No./N° VME**
PWL-3-36066 (023)	

Solicitation Closes - L'invitation prend fin
at - à 02:00 PM
on - le 2014-01-21

Time Zone
Fuseau horaire
Eastern Standard Time
EST

F.O.B. - F.A.B.
Plant-Usine: ☐ **Destination:** ☑ **Other-Autre:** ☐

Address Enquiries to: - Adresser toutes questions à:	**Buyer Id - Id de l'acheteur**
Lau, Karen	pwl023

Telephone No. - N° de téléphone	**FAX No. - N° de FAX**
(416) 512-5297 ( )	(416) 512-5862

Destination - of Goods, Services, and Construction:
Destination - des biens, services et construction:
Randle Reef
Hamilton Harbour
Hamilton, ON

Instructions: See Herein

Instructions: Voir aux présentes

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Delivery Required - Livraison exigée	**Delivery Offered - Livraison proposée**

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Telephone No. - N° de téléphone
Facsimile No. - N° de télécopieur

Name and title of person authorized to sign on behalf of Vendor/Firm (type or print)
Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)

Signature **Date**

Canada

REQUEST FOR PROPOSAL

(ONE PHASE PROCEDURE)

RANDLE REEF - SEDIMENT REMEDIATION: STAGE 1 - CONSTRUCTION ENGINEERING SERVICES

HAMILTON HARBOUR

HAMILTON, ONTARIO

SOLICITATION No.: EQ754-141656/A
PROJECT No.: R.050927.001

PWGSC Contracting Authority:

Karen Lau
4900 Yonge Street
Toronto, Ontario M2N 6A6
Telephone: 416-512-5297
Fax: 416-512-5652
Email: karen.lau@pwgsc-tpsgc.gc.ca

REQUEST FOR PROPOSAL (RFP)

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SUPPLEMENTARY INSTRUCTIONS TO PROPONENTS (SI)

SI1 INTRODUCTION

1. Public Works and Government Services Canada (PWGSC) intends to retain an individual consulting firm or joint venture to provide the professional services for the project as set out in this Request for Proposal (RFP).

2. This is a single phase selection process. The nature of the requirement and the anticipated limited number of response by the industry leads PWGSC to believe that this approach will not unduly force a large number of firms to expend an overall unreasonable amount of effort in response to PWGSC.

3. Proponents responding to this RFP are requested to submit a full and complete proposal. The proposal will cover not only the qualifications, experience and organization of the proposed Consultant Team, but also the detailed approach to the work, and the pricing and terms offered. A combination of the technical and price of services submissions will constitute the proposal.

SI2 PROPOSAL DOCUMENTS

1. All instructions, general terms, conditions and clauses identified in the RFP by number, date and title, are hereby incorporated by reference into and form part of this solicitation and any resultant contract.

   All instructions, general terms, conditions and clauses identified in the RFP by number, date and title, are set out in the Standard Acquisition Clauses and Conditions Manual (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

2. The following are the proposal documents:

   (a) Supplementary Instructions to Proponents (SI);
   R1410T (2013-06-27), General Instructions to Proponents (GI);
   Submission Requirements and Evaluation (SRE);

   (b) the general terms, conditions and clauses, as amended, identified in the Agreement clause;

   (c) Project Brief ;

(d) the document entitled "Schedule";

(e) the document entitled "Proposed Work Management Decision Criteria for Sydney Tar Ponds and Coke Ovens Clean Up Project Benzene & Naphthalene";

(f) any amendment to the solicitation document issued prior to the date set for receipt of proposals; and

(g) the proposal, Declaration/Certifications Form and Price Proposal Form.

3. Submission of a proposal constitutes acknowledgment that the Proponent has read and agrees to be bound by these documents.

SI3 QUESTIONS OR REQUEST FOR CLARIFICATION

Questions or requests for clarification during the solicitation period must be submitted in writing to the Contracting Authority named on the RFP - Page 1 as early as possible. Enquiries should be received no later than ten (10) working days prior to the closing date identified on the front page of the Request for Proposal. Enquiries received after that date may not be answered prior to the closing date of the solicitation.

SI4 CANADA'S TRADE AGREEMENTS

This procurement is subject to the provisions of the North American Free Trade Agreement (NAFTA), the World Trade Organization - Agreement on Government Procurement (WTO-AGP), the Canada-Colombia Free Trade Agreement (FTA) and the Canada-Peru FTA.

SI5 CERTIFICATIONS

1. Code of Conduct and Certifications - Related Documentation

By submitting a proposal, the Proponent certifies that the Proponent and its affiliates are in compliance with the provisions as stated in Section GI1 Code of Conduct and Certifications - Proposal of R1410T (2013-06-27) General Instructions to Proponents (GI). The related documentation therein required will assist Canada in confirming that the certifications are true.

2. Federal Contractors Program for Employment Equity - Proposal Certification

By submitting a proposal, the Proponent certifies that the Proponent, and any of the Proponent's members if the Proponent is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list (http://hrsdc.gc.ca/eng/labour/index.shtml) available from Human Resources and Skills Development Canada (HRSDC) -Labour's website.

Canada will have the right to declare a proposal non-responsive if the Proponent, or any member of the Proponent if the Proponent is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list at the time of contract award.

Canada will also have the right to terminate the Agreement for default if a Consultant, or any member of the Consultant if the Consultant is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list during the period of the Agreement, when the Agreement is valued at $1,000,000 and above, applicable Taxes included.

The Proponent must provide the Contracting Authority with a completed Federal Contractors Program for Employment Equity - Certification (see Appendix B - Declaration/Certifications Form), before contract award. If the Proponent is a Joint Venture, the Proponent must provide the Contracting Authority with a completed Federal Contractors Program for Employment Equity - Certification, for each member of the Joint Venture.

SI6 WEBSITES

The connection to some of the Web sites in the RFP is established by the use of hyperlinks. The following is a list of the addresses of the Web sites:

Employment Equity Act
http://laws.justice.gc.ca/en/E-5.401/index.html

Federal Contractors Program (FCP)
http://www.hrsdc.gc.ca/eng/labour/equality/fcp/index.shtml

Certificate of Commitment to Implement Employment Equity form LAB 1168
http://www.servicecanada.gc.ca/cgi-bin/search/eforms/index.cgi?app=profile&form=lab1168&dept=sc&lang=e

Code of Conduct for Procurement
http://www.tpsgc-pwgsc.gc.ca/app-acq/cndt-cndct/contexte-context-eng.html
Consent to a Criminal Record Verification (PWGSC-TPSGC 229 form)
http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/formulaires-forms-eng.html

Lobbying Act
http://laws-lois.justice.gc.ca/eng/acts/L-12.4/?noCookie

Contracts Canada
https://buyandsell.gc.ca/

Supplier Registration Information
https://srisupplier.contractscanada.gc.ca

Consultant Performance Evaluation Report Form
http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/2913-1.pdf

Canadian economic sanctions
http://www.international.gc.ca/sanctions/index.aspx?lang=eng

National Joint Council (NJC) Travel Directive
Http://www.njc-cnm.gc.ca/directive/travel-voyage/index-eng.php

SI7 CHANGES TO CLAUSE R1410T (2013-06-27) GENERAL INSTRUCTIONS TO PROPONENTS

'R1410T GI3 (2012-07-16) Overview of Selection Procedure, article 3.2.5 Proposal Evaluation and Rating' is deleted and replaced with the following:

G13 3.2 Proposal Evaluation and Rating

5. The remaining prices proposals are rated as follows:

a. The lowest price proposal receives a Price Rating/maximum Score of 40;
b. Other price proposals will receive a Score based on the following formula:

Lowest Price Proposal ____ x 40 points = Price Rating/Score

Proponent Price Proposal

TERMS, CONDITIONS AND CLAUSES

AGREEMENT

1. The Consultant understands and agrees that upon acceptance of the offer by Canada, a binding Agreement shall be formed between Canada and the Consultant and the documents forming the Agreement shall be the following:

   (a) the Front Page and this Agreement clause;
   (b) the General Terms, Conditions and Clauses, as amended, identified as:
   R1210D (2013-06-27), General Condition (GC) 1 - General Provisions
   R1215D (2011-05-16), General Condition (GC) 2 - Administration of the Contract
   R1220D (2011-05-16), General Condition (GC) 3 - Consultant Services
   R1225D (2012-07-16), General Condition (GC) 4 - Intellectual Property
   R1230D (2012-07-16), General Condition (GC) 5 - Terms of Payment
   R1235D (2011-05-16), General Condition (GC) 6 - Changes
   R1240D (2011-05-16), General Condition (GC) 7 - Taking the Services Out of the Consultant's Hands, Suspension or Termination
   R1245D (2012-07-16), General Condition (GC) 8 - Dispute Resolution
   R1250D (2012-07-16), General Condition (GC) 9 - Indemnification and Insurance
   Supplementary Conditions
   Agreement Particulars
   (c) Project Brief;
   (d) the document entitled "Schedule";
   (e) the document entitled "Proposed Work Management Decision Criteria for Sydney Tar Ponds and Coke Ovens Clean Up Project Benzene & Naphthalene";
   (f) any amendment to the solicitation document incorporated in the Agreement before the date of the Agreement; .
   (g) the proposal, the Declaration/Certifications Form and the Price Proposal Form.

2. The documents identified above by title, number and date are hereby incorporated by reference into and form part of this Agreement, as though expressly set out herein, subject to any other express terms and conditions herein contained.

   The documents identified above by title, number and date are set out in the Standard Acquisition Clauses and Conditions (SACC) Manual, issued by Public Works and Government Services Canada (PWGSC). The SACC Manual is

available on the PWGSC Web site: https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual

3. If there is a discrepancy between the wording of any documents that appear on the following list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

(a) any amendment or variation in the Agreement that is made in accordance with the terms and conditions of the Agreement;
(b) any amendment to the solicitation document incorporated in the Agreement before the date of the Agreement;
(c) this Agreement clause;
(d) Supplementary Conditions;
(e) General Terms, Conditions and Clauses;
(f) Agreement Particulars;
(g) Project Brief;
(h) the document entitled "Schedule";
(i) the document entitled "Proposed Work Management Decision Criteria for Sydney Tar Ponds and Coke Ovens Clean Up Project Benzene & Naphthalene";
(j) the proposal.

SUPPLEMENTARY CONDITIONS (SC)

SC1 FEDERAL CONTRACTORS PROGRAM FOR EMPLOYMENT EQUITY - DEFAULT BY THE CONSULTANT

The Consultant understands and agrees that, when an Agreement to Implement Employment Equity (AIEE) exists between the Consultant and HRSDC-Labour, the AIEE must remain valid during the entire period of the contract. If the AIEE becomes invalid, the name of the Consultant will be added to the "FCP Limited Eligibility to Bid" list. The imposition of such a sanction by HRSDC will constitute the Consultant in default as per the terms of the contract.

AGREEMENT PARTICULARS

The Agreement Particulars will be issued at time of award of contract and will identify the fee to be paid to the Consultant for the services determined in the Price Proposal Form.

PROJECT BRIEF

Description of Project (PD)

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PD 2 Project Identification
PD 3 Project Background
PD 4 Existing Documentation
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Description of Services (PA)

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Required Services (RS)

RS 1 Analysis of Project Requirements
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OS 1 Bid Evaluation & Construction Contract Award

PROJECT BRIEF

This Project Brief is divided into two (2) sections:

- Description of Project (PD)
- Description of Services: Project Administration (PA)
  Required Services (RS)
  Optional Services (OS)

DESCRIPTION OF PROJECT (PD)

PD 1 PROJECT INFORMATION

Public Works and Government Services Canada (PWGSC) intends to retain an Civil engineering consulting firm for the provision of the services required for this project.

1.1	**PWGSC Project Title:**	Randle Reef - Sediment Remediation Stage 1: Construction Engineering Services
1.2	**Location of the Project:**	Hamilton Harbour, Hamilton, Ontario, Canada
1.3	**PWGSC Project Number:**	R.050927.001
1.4	**Client/User:**	Environment Canada (EC), Sediment Remediation Unit, Great Lakes Areas of Concern Section, Great Lakes Division
1.5	**PWGSC Project Manager:**	Ronald Hewitt

PD 2 PROJECT IDENTIFICATION

2.1 Description

Randle Reef is an area of highly contaminated sediment located on the south shore of Hamilton Harbour, in the western end of Lake Ontario. Sediment remediation is required to reduce the environmental impacts of contaminants including polycyclic aromatic hydrocarbons (PAHs) and heavy metals located at this site, which will lead to the restoration and eventual delisting of the Hamilton Harbour as an Area of Concern. The funding for this project relates to a Cabinet submission for the cleanup of contaminated sediment in designated Areas of Concern of the Great Lakes.

Environment Canada is the lead agency for a group of funding partners involved in the project. The funding partners include the Ontario Ministry of the Environment, Hamilton Port Authority, U.S Steel, City of Hamilton, City of Burlington and Region of Halton. EC have contracted PWGSC to carry out the procurement and project management for the remediation.

Randle Reef Remediation Project is a project to dredge and contain 630,000 m3 of contaminated sediment in the Hamilton Harbour Area of Concern. The site represents the largest area of contaminated sediment on the Canadian side of the Great Lakes. In Canada, it is the largest known sediment site contaminated by PAHs (Polycyclic Aromatic Hydrocarbons). The project proposes to contain the most severely contaminated sediment in place through constructing an engineered containment facility of approximately 7.5 hectares. Surrounding contaminated sediment will be dredged and placed in the containment facility and capped. The after use of the site will include port facilities on two thirds of the site and light industrial use and/or naturalization of the remaining one third of the structure.

The Engineered Confinement Facility (ECF) isolation structure will be constructed with double steel sheet pile walls. The outer wall will be used to satisfy structural requirements while the inner wall will provide environmental isolation of the sediments as well as anchorage for the outer wall. The contaminated sediment deposited within the ECF will be de-watered and the decant water produced by this process will be treated by an on-site water treatment system to meet project specific discharge criteria related to Ontario Ministry of the Environment (MOE) water quality requirements before being discharged back into Hamilton Harbour. Once dewatering is completed, the contained sediment will be covered by a multi layer environmental cap. Following project completion, the Hamilton Port Authority (HPA) will assume ownership of the facility and will be responsible for ongoing monitoring and maintenance.

The project will be completed in three distinct stages:

Stage I - Construction of a marine double wall ECF enclosure and a wharf at Pier 15. This includes dredging of contaminated sediments from between the walls and backfilling with clean rock fill.

Stage II - Dredging of contaminated sediments and depositing them within the ECF up to water level. Other remediation areas will be capped using both thin layer capping and isolation capping techniques.

Stage III - ECF sediment dewatering, capping above water level and consolidating of contaminated sediments within the ECF structure with engineered materials (stone, sand, geotextiles, geomembranes, pipes, asphalt etc).

Following the completion of the project, two-thirds of the site will be developed into a marine terminal which will be suitable for ships of Great Lakes Seaway draught, providing access to berths along Pier 15, northwest of Sherman Inlet. The remaining one-third of the site will either be maintained as vegetated green space or surfaced with a suitable aggregate material and used as light industrial space.

2.2 Scope of Services

The scope of services include Civil Engineering consulting services required during **STAGE I CONSTRUCTION ONLY** of this project.

2.3 Cost

The Class B construction costs estimate for Stage I is between $25,000,000 and $35,000,000 excluding owner supplied materials and HST.

2.4 Schedule

A preliminary schedule is enclosed in Appendix F. The anticipated start date for Stage I construction is Spring 2014 and is scheduled to be completed in 24 months.

PD 3 PROJECT BACKGROUND

3.1 Project Background

The Government of Canada and the United States have recognized that contaminated sediments pose significant environmental risks to the Great Lakes ecosystem. In 1985, these two countries identified 43 Areas of Concern (AOCs) where impaired water quality prevented full beneficial use of rivers, bays, harbours, and ports. Under the Canada-United States Great Lakes Water Quality Agreement, the Government of Canada has committed to remediating the 14 remaining Canadian AOCs, including Hamilton Harbour where Randle Reef is located.

Hamilton Harbour is a 2,150 ha embayment located at the western end of Lake Ontario and connected to the lake by a single ship canal across the sandbar that forms the bay. The conditions in the Harbour reflect natural inputs, human activities, land uses and drainage from a watershed of 49,400 ha. The Harbour accommodates a commercial port and is considered to be a major shipping centre. The south shore of the Harbour supports the highest concentration of heavy metal industry (primarily iron and steel) in Canada.

The contaminated sediment targeted for remediation is located at Randle Reef along the south shore of Hamilton Harbour in the vicinity of Piers 14, 15 and 16. The ECF will be connected to Pier 15, owned by the Hamilton Port Authority, located south of the property owned by U.S. Steel Canada (formerly Stelco).

With the remediation of the Sydney Tar Ponds completed, Randle Reef is now the largest polycyclic aromatic hydrocarbon (PAH) contaminated sediment site in Canada. Owing to the long history of contamination (more than 150 years), from multiple sources, it is not possible to apply the polluter pay principle. Instead, a shared responsibility model has been adopted with the Government of Canada, Government of Ontario and local community participating equally in the design and implementation of a solution. This legacy site is a priority for remediation in the Hamilton Harbour Remedial Action Plan (RAP) and under the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA).

Randle Reef sediments contain polycyclic aromatic hydrocarbons (PAHs) in very high concentrations as well as heavy metals. The contamination is often described as "a spill in slow motion" due to the continuing slow spread of contaminants across the harbour floor and uptake into the food chain. The uptake of PAHs from sediment into the food chain affects local fish and wildlife populations both directly and indirectly. The Randle Reef Sediment Remediation Project will isolate these contaminants from the ecosystem, thereby eliminating direct pathways of exposure to PAHs by ecological receptors. Remediation of Randle Reef will improve water quality and reduce contaminant levels in biota. It will also remove current restrictions on navigation and generate economic returns through the creation of valuable port lands.

The Government of Canada is committed to the delisting of the Hamilton Harbour AOC targeting 2020 under the RAP. The remediation of contaminated sediments at Randle Reef is critical to achieving RAP delisting criteria concerning degradation of benthos, fish tumours and other deformities, degradation of phytoplankton and zooplankton populations and loss of fish and wildlife habitat.

3.2 Project Considerations

1. **Work Site Area** - The land where the ECF is to be constructed is owned by Hamilton Port Authority, who is one of the funding partners. PWGSC has unrestricted use of two staging areas; 4.2 acres located on the eastern portion of Pier 15 adjacent to the ECF footprint and 1.7 acres on the western portion of Pier 15 adjacent to the Pier 15 Dockwall re-construction. Shipping in the harbour will be ongoing throughout the construction period. Navigation takes precedence over construction activity. US Steel operate intake and outfall structures and the structures are located adjacent to the east side of the ECF wall.

2. **Steel Supply** - Owner supplied material is a contribution of fabricated steel sheet piles. Fabricated steel sheet piles for the inner (sealed) wall of the ECF will be provided on-site by US Steel Canada. Steel for the outer wall and internal dividing wall will be fabricated under a separate contract by the owner.

These fabricated steel sheet piles will be provided by the owner and available for pick up by the contractor at a designated fabrication mill.

PD 4 EXISTING DOCUMENTATION

4.1 Existing Documentation - Available for all proponents

1. Stage I design drawings and specifications (version 0)
2. Randle Reef Sediment Remediation Project Comprehensive Study Report, October 30 2012 (CSR)

4.2 Access to Documentation for Proponents

Available upon request to Proponents interested in submitting proposals. Requests for Existing Documentation must be submitted in writing to the Contracting Authority named on Page 1 as early as possible.

PD 5 PROJECT OBJECTIVES

5.1 Quality

Construction quality to meet Civil and Marine Engineering standards related to construction of marine structures. Refer to PD 4.1 Existing Documentation - Available for all proponents - 1. Stage I design drawings and specifications (version 0)

5.2 Sustainable Development

The Canadian Federal Government has begun a series of initiatives to ensure that sustainable development principles are built into the policy of all federal organizations. Public Works and Government Services Canada (PWGSC) like all federal departments requires having a Sustainable Development Strategy (SDS). Real Property Services Branch of PWGSC has developed their Strategy Plan that sets out principles, goals and actions for integrating sustainable development principles into its policies and operations.

Sustainable Development is defined in broad terms as a strategy that routinely and consistently includes the consideration of the environmental, economic and societal impact of every decision made for the project. The general areas of focus include:

1. Energy efficiency and conservation,
2. Greenhouse gas emissions reduction,
3. Water management and conservation,
4. Pollution prevention,
5. Product selection and resource conservation,
6. Site conservation (protection and preservation of valued natural site features),
7. Environmentally friendly maintenance procedures and products.

5.3 Waste Management

The Construction, Renovation, and Demolition (CRD) Non-hazardous Solid Waste Management Protocol to which Real Property Services (RPS) is bound, provides directions on the undertaking of non-hazardous solid waste management actions for CRD projects. The protocol is designed to meet the requirements of federal and provincial policies and the objectives of the RPS Sustainable Development Strategy (SDS) as these relate to non-hazardous solid waste generated in CRD projects.

5.4 Code Compliance

Codes, regulations, by laws and decisions of "authorities having jurisdiction" will be observed. In cases of overlap, the most stringent will apply. The Consultant shall identify other jurisdictions appropriate to the project.

5.5 Risk Management

A risk management strategy is crucial for PWGSC Project Management and integrates project planning into procurement planning. All the stakeholders of a project will be an integral part of the risk management strategy, culminating in an integrated product team. Specific services required for project delivery are outlined in Required Services.

5.6 Health and Safety

Public Works and Government Services Canada (PWGSC), recognizes the responsibility to ensure the health and safety of all persons on Crown construction projects and the entitlement of both federal employees and private sector workers to the full protection afforded them by occupational health and safety regulations.
In keeping with the responsibility and in order to enhance health and safety protection for all individuals on federal construction sites, PWGSC will voluntarily comply with the applicable provincial/territorial construction health and safety acts and regulations, in addition to the related Canada Occupational Safety and Health Regulations.

PD 6 ISSUES

6.1 Major Time Issues

Issue: Delay in delivery and use of Steel Sheet Piles (SSP) and steel material
Strategy to control time: Agreement with US Steel; QA/QC of SSP and steel material; Separate contract to fabricate SSP; Coordinated and controlled delivery of SSP and steel material; Coordination with Stage 1 Construction Contractor; Staging Plan.

PD 7 CONSULTANT SERVICES

1. The prime consultant shall be responsible to co-ordinate and direct all consultant team activities.

2. The consultant team shall be comprised of qualified professional and technical expertise with extensive relevant experience, and shall be capable of providing the services identified in the Required Services (RS) and Optional Services (OS) section of this Project Brief.

3. The following Required Services (RS) are the overall Consultant Services required to deliver this project:

REQUIRED SERVICES (RS)

RS 1 - Analysis of Project Requirements
RS 2 - Construction and Contract Administration
RS 3 - Resident Site Services during Construction

Despite any other condition of the Contract, the Consultant is only authorized to perform the Work identified as Required Services of the Contract. Canada reserves the right to contract for the following Optional Services, or part thereof, through either negotiation with the Consultant or to contract separately with other firms/ Consultants:

OPTIONAL SERVICES (OS)

OS 1 - Bid Evaluation & Construction Contract Award

If Canada decides to continue with the Work identified as Optional Services of the Contract, the Contracting Authority will advise the Consultant in writing to

commence the Work identified as Optional Services. The Consultant must immediately comply with the notice.

In no event will the Consultant be paid for any cost incurred for unauthorized work.

4. The consultant team for this project must be capable of providing the following services

   a. Marine engineering
   b. Environmental engineering
   c. Civil/structural engineering
   d. Project management
   e. Geotechnical engineering
   f. Mechanical engineering,
   g. Electrical engineering
   h. Time control
   i. Cost control
   j. Air quality monitoring
   k. Risk management
   l. Waste management
   m. Sustainable development
   n. Sediment remediation
   o. Monitoring
   p. Contract management
   q. Construction supervision
   r. Communications
   s. H&S management

DESCRIPTION OF SERVICES

PROJECT ADMINISTRATION (PA)

PA 1 PROJECT ADMINISTRATION (PA)

1.1 PWGSC Project Management

The Project Manager assigned to the project is the Departmental Representative.

The Project Manager is the Departmental officer directly concerned with the project and responsible for its progress. The Project Manager is the liaison between the Consultant, Public Works and Government Services Canada and the Client Department.

Public Works and Government Services Canada administers the project and exercises continuing control over the Consultant's work during all phases of development. Authorization has already been sought from the Department of Fisheries and Oceans and Transport Canada under the Fisheries Act and Navigable Waters Protection Act, respectively.

Unless directed otherwise by the Project Manager, the Consultant obtains any additional federal, provincial, and municipal requirements and approvals necessary for the work.

1.2 Lines of Communication

Unless otherwise arranged with Project Manager, the Consultant shall communicate with the Project Manager only. There shall be no direct official contact between Client Department and the Consultant, unless approved in writing by the Project Manager.

During construction tender call, Public Works and Government Services Canada conducts all correspondence with bidders and makes the contract award.

1.3 Media

The Consultant shall not respond to requests for project related information or questions from the media. Such inquires are to be directed to the Project Manager.

1.4 Meetings

Attend meetings as outlined in document under PD 4.1 Existing Documentation - Available for all proponents - 1. Stage I design drawings and specifications (version 0)

1.5 Project Response Time

It is a requirement of this project that the key personnel of the successful proponent and sub consultant or specialist firms be personally available to attend meetings or respond to inquiries in a manner, that does not delay the construction project.

REQUIRED SERVICES (RS)

RS 1 ANALYSIS OF PROJECT REQUIREMENTS

1.1 INTENT

The purpose of this stage is to ensure the consultant has reviewed and integrated all the project requirements, identified and evaluated conflicts or problems, provide alternative strategies, presented and received approval on a Project scope, delivery process, schedule and estimate required to deliver a cohesive quality project. This approved deliverable will become the Project Scope of Services and will be utilized throughout the project to guide the delivery.

1.2 GENERAL

Scope and Activities:

1. Visit the site and verify the availability and capacity of services needed for the project
2. Attend project start up meeting
3. Analyze the project requirements/program
4. Review all available existing material related to the project
5. Review the proposed project schedule for verification that all milestone dates are achievable
6. Review the cost plan/budget for verification that the costs are realistic and achievable
7. Identify and verify all authorities having jurisdiction over the project
8. Identify the codes, regulations and standards that apply
9. Establish a policy for project to minimize environmental impacts consistent with the project objectives and economic constraints
10. Review potential for environmental impacts and application of the Comprehensive Study Report (CSR).

1.3 DELIVERABLES:

1. Comprehensive summary of the project requirements/program demonstrating understanding of the scope of work including:
2. Report on existing information and identify any missing information
3. Confirmed or adjusted project cost and time plans
4. Written identification of the problems, conflicts or other perceived information/clarifying assumptions for the acknowledgment of the project manager

RS 2 CONSTRUCTION AND CONTRACT ADMINISTRATION

2.1 INTENT

To implement the project in compliance with the Contract Documents (Stage 1 Design Drawings and Specifications (version 0)) and to direct and monitor all necessary or requested changes to the scope of work during construction.

2.2 GENERAL

Scope and Activities:

1. During the implementation of the project, act on PWGSC's behalf to the extent provided in this document
2. Perform updates and changes to the contract as required by the Retained Engineer (design engineer who completed contract documents). Retained Engineer will be retained by PWGSC under a separate contract.
3. Carry out the review of the work at intervals appropriate to determine if the work is in conformity with the Contract Documents
4. Keep PWGSC informed of the progress and quality of the work and report any defects or deficiencies in the work observed during the course of the site review
5. Determine the amounts owing to the Contractor based on the progress of the work and certify payments to the contractor
6. Act as interpreter of the requirements of the Contract Documents
7. Provide cost advice during construction
8. Advise the Project Manager of all potential changes to scope for the duration of the implementation
9. Review the Contractor's submittals
10. Prepare and justify change orders for issue by the Departmental Representative
11. Indicate any changes or material/equipment/personnel substitutions on Record Documents
12. During the twelve (12) month warranty period investigate all defects and alleged defects and issue any corrective instructions to the Contractor
13. Conduct a final warranty review
14. The consultant is to provide support to the Project Manager in identifying risks throughout the project life cycle.

2.3 DETAILS

Scope and Activities:

2.3.1 Construction Meetings

1. Immediately after contract award arrange a briefing meeting with the Contractor and the Departmental Representatives. Prepare minutes of the meeting and distribute copies to all participants and to other persons agreed upon with the Project Manager.
2. Call job meetings as frequently as required, commencing with the construction briefing meeting. The meetings should include the job superintendent, Inspector of Construction main subcontractors, affected sub-consultants and Government Services representatives as necessary. Prepare minutes of the meeting and distribute copies to all participants. The Project Manager may invite representative(s) from the Client Department to attend any of these meetings. Allow for on-site meeting with Project Manager on a weekly basis.

2.3.2 Project Schedule

1. Obtain Project Schedule with detailed commissioning component shown separately, as soon as possible after contract award and ensure proper distribution.
2. Monitor the approved construction schedule, take necessary steps to ensure that the schedule is maintained and submit a detailed report to the Departmental Representative concerning any delays.
3. Keep accurate records of causes of delays.
4. Make every effort to assist the Contractor to avoid delays.

2.3.3 Time Extensions

Only the Departmental Representative may approve any request for Time Extensions. Approval will be issued in writing by the Project Manager.

2.3.4 Cost Breakdown

Obtain from the Contractor detail cost breakdown on standard PWGSC form and submit to the Departmental Representative with the first Progress Claim.

2.3.5 Sub-contractor Changes

1. The Contractor is required to use the sub-contractors listed on the tender form unless a change is authorized by the Departmental Representative. Changes are only considered when they involve no increase in cost. Review all requests for changes of sub-contractors, and submit recommendations to the Project Manager.
2. When sub-contractors have not been listed on the Tender Form, obtain the list from Contractors not later than 10 working days after date of award.

2.3.6 Labour Requirements

1. The Contractor is bound by the Contract to maintain competent and suitable workmen on the project and to comply with the Canada Department of Labour - Labour Conditions. Inform the Departmental Representative of any labour situations that appear to require corrective action by the Departmental Representative.
2. The Consultant shall ensure that a copy of the Labour Conditions for the Contract is posted in a conspicuous place on site.

2.3.7 Regulatory Compliance

1. Enure that construction complies with applicable acts, regulations, codes and municipal bylaws.
2. Matters pertaining to the Federal Occupational Health and Safety legislation shall be referred to the Departmental Representative.

2.3.8 Construction Safety

1. All construction projects that are occupied by federal employees during construction are subject to the Canada Occupational Safety and Health Act and Regulations as administered by Health and Welfare Canada.
2. Fire safety provisions during construction must comply with FCC Standards 301 and 302, administered by the Fire Commissioner Canada.
3. In addition to the above, the Contractor must comply with the provincial and municipal safety laws and regulations, and with any instructions issued by the officers of these authorities having jurisdiction relating to construction safety.

2.3.9 Construction Supervision

1. Ensure compliance with contract documents.
2. Provide services of qualified personnel who are fully knowledgeable with technical and administrative requirements of project.

3. Establish a written understanding with contractors as to what stages or aspect of the work are to be inspected prior to being covered up.
4. Assess quality of work and identify in writing to the Contractor and to the Departmental Representative all defects and deficiencies observed at time of such inspections.
5. Inspect materials and prefabricated assemblies and components at their source or assembly plant, as necessary for the progress of the project.
6. Any directions, clarifications or deficiency list shall be issued in writing to PWGSC.

2.3.10 Clarifications

Provide clarifications on Plans and Specifications or site conditions, as required in order that project not be delayed.

2.3.11 Progress Reports

Report to the Departmental Representative regularly on the progress of the work. Submit weekly reports. Using tables, graphs, maps and other appropriate means show weekly and cumulative progress in a form that can be easily interpreted. Prior to first report, provide sample of weekly report format for review and approval by Departmental Representative.

2.3.12 Work Measurement

1. If work is based on unit prices, measure and record the quantities for verification of monthly progress claims and the Final Certificate of Measurement.
2. When Contemplated Change Notice is to be issued based on Unit Prices, keep accurate account of the work. Record dimensions and quantities.

2.3.13 Detail Drawings

Provide for the Departmental Representative's information any additional detail drawings as and when required to properly clarify or interpret the contract documents.

2.3.14 Shop Drawings

1. On completion of the project, forward three copies of reviewed shop drawings to the Departmental Representative. Ensure that shop drawings include the project number and are recorded in sequence.
2. Verify the number of copies of shop drawings required. Consider additional copies for Client Departmental review.

3. Shop drawings shall be stamped: "Checked and Certified Correct for Construction" by the Contractor and stamped: "reviewed" by the Consultant before return to the Contractor.
4. Expedite the processing of Shop Drawings.

2.3.15 Inspection and Testing

1. Prior to commencement of on-site work and as early as schedule permits, provide the Departmental Representative with recommended list of tests to be undertaken, including on site and factory testing.
2. When contract is awarded, assist the Departmental Representative in briefing testing firm on required services, distribution of reports, communication lines, etc.
3. Review all test reports and take necessary action with Contractor when work fails to comply with contract.
4. Immediately notify the Departmental Representative when tests fail to meet project requirements and when corrective work will affect schedule.
5. Assist the Departmental Representative in the setting up of post monitoring program.
6. Assist the Departmental Representative in evaluating testing firm's invoices for services performed.

2.3.16 Environmental Testing and Monitoring

In-water work will generally consist of sheet pile driving, debris removal along the sheet pile driving line, dredging between the sheet pile walls and the reconstruction of a section of the western portion of the Pier 15 dock wall.

Prior to tender award, the consultant shall provide the Departmental Representative with an Environmental Quality Monitoring Plan for review and approval, which will include, as a minimum, details on water quality and air quality monitoring. Further details are provided below:

2.3.16.1 Water Quality Monitoring:

1. Demonstrate how the proposed monitoring plan will conform to the construction specifications and adjustments as required. Outline details of monitoring activities including, but not limited to, timing and frequency,

2. Allow for on-site meetings at the beginning of the construction contract and if necessary during the contract, with Departmental Representative and Client to review and refine monitoring plan.

3. Departmental Representative at start-up of piling installation and at start up of dredging and thereafter on a bi-weekly basis, may be accompanied by Client to witness testing and request further testing using Client equipment as required.

4. Adjust monitoring plan to suit findings as directed by the Departmental Representative.

Supplied Data:
The Departmental Representative will supply a site-specific laboratory-generated Turbidity to TSS relationship along with a supporting report developed by Environment Canada for use during water quality monitoring. This relationship between real time Nephelometric Turbidity Units(NTU) measurements in the field and corresponding TSS units (mg/L) is required as it is the water quality monitoring criteria the contractor must abide by. The consultant will utilize this relationship and update this correlation using on-site data obtained as follows.

Requirements:

Turbidity Monitoring

1. Provide plans and details of three fixed monitoring stations to establish daily background conditions as well as protocol as to how this will be established. Monitoring stations for background shall be within 1,000 m of the in-water work area. Assume 1 sampling event per station per day at the beginning of work. If, in the course of a workday, significant changes occur that warrant a reassessment of background conditions, the consultant will be required to conduct background monitoring on a more frequent basis.

   Provide the protocol for supplying the contractor with a daily in-water work criterion (in NTUs). This will include using floating background data, the specified TSS engineering performance standard (25 mg/L above a floating background value, 100 m from the in-water work, when background levels are less than or equal to 60 mg/L. Where background TSS exceeds 60 mg/L, the maximum allowable TSS will be 85 mg/L).

2. Provide plans and details of in-water turbidity monitoring including, but not limited to, proposed equipment, sampling frequency, sampling methodology, analytical QA/QC, calibration practices, field procedures and reporting details and protocols. At the start of monitoring, methods such as a 4 hour rolling average can be used to measure against compliance. Assume 6 sampling events per station (assume 3 compliance stations sampled every 2 hours during a 12 hour workday) per day to determine compliance at 100 m from the in-water work.

3. Quantify the relationship between TSS values to turbidity during in-water work to either verify or replace the relationship established by Environment Canada.

Surface Water Monitoring

1. In conjunction with turbidity monitoring, surface water sample collection will be triggered when the NTU value that corresponds to 15 mg/L TSS above background is measured at the compliance point. The frequency of sampling shall be assumed to be up to a maximum of 8 times per month for chemistry and 16 times per month for TSS. Surface water samples will be analyzed for PAHs, TSS and metals. Laboratory analysis shall be at detection limits capable of meeting the Provinical Water Quality Objectives (PWQOs). This program can be altered at the discretion of the Project Manager pending the results found. This data will be provided to Departmental Representative, for assessing the accuracy of previously derived in-water work guidelines.

2.3.16.2 Sediment Verification Sampling Between Sheetpile Walls

Requirements:

Once the required dredging depth has been reached, the consultant shall allow for a minimum of 50 core samples for the perimeter of the ECF submitted for analysis of PAHs US Environmental Protection Act (USEPA) 16 priority. Core samples must achieve a clay plug. The consultant must propose a method to identify acceptable conditions for the dredged areas between the walls considering the specified fill material that is being placed upon the dredged surface and the 100 mg/kg total PAH site specific remediation criteria. Where

conditions are not acceptable the consultant shall develop a plan for second pass dredging.

2.3.16.3 Air Monitoring:

Supplied Data and Equipment:

The departmental representative will supply to Consultant, site-specific background air quality information along with a supporting report developed by the Ontario Ministry of the Environment for use during air quality monitoring.

Also refer to the air quality section of the Randle Reef Sediment Remediation Project Comprehensive Study Report, October 30 2012 (CSR) in PD 4.1 Existing Documentation, which includes a summary of air modeling establishing naphthalene as the primary contaminant of concern related to air emissions from the project.

The departmental representative will supply equipment, including a portable GCMS HAPSITE® ER unit and associated components and apparatus (GCMS unit). The Consultant will retain this equipment on-site in a securely locked trailer, supplied by the Consultant and of adequate size to perform the appropriate testing for the duration of the contract. The consultant will supply all disposables for use with the equipment. At the completion of work the Consultant will overhaul the equipment to the original condition and return the equipment to the Departmental Representative.

Requirements:

1. Provide a detailed plan for a comprehensive air monitoring program to ensure compliance with provincial ambient air quality criteria (AAQC) and in order to meet the requirements of the Randle Reef Sediment Remediation Project Comprehensive Study Report, October 30 2012.

    a. As part of the detailed plan for the comprehensive air monitoring program a real time monitoring target (total VOCs or approved alternative) which correlates to a protective value intended to prevent an exceedance of the 24 hour naphthalene AAQC criteria of 22.5 ug/m3. This real time monitoring target will be established in order to determine the need for the collection of verification air samples (24 hour) for analysis via an GCMS unit and to provide

direction to the construction contractor on any required work alterations or work suspension. The methodology may vary, but the objective is to develop a management tool by way of an action level for the purposes of alerting to potentially developing air quality issues. The method must be easy and cost effective to implement, and monitor in real-time. An example correlation is provided in Appendix F Proposed Work Management Decision Criteria for Sydney Tar Ponds and Coke Ovens Clean Up Project Benzene & Naphthalene.

b. The comprehensive air monitoring program would incorporate;

- Real time monitoring (total VOCs or approved alternative) at points along the Site boundary as indicated on the contract drawing MA 1.1, and downwind of project activities for the duration of in the Stage 1 in water work which disturbs the sediment;
- Verification air sample collection (24 hour), for VOC analysis, defined in Appendix F, via laboratory or on-site GCMS unit, triggered by the exceedance of the real time monitoring criteria during the real time monitoring;
- Weekly air sample collection (24 hour) once a week during, for VOC analysis via laboratory or on site GCMS unit;
- The collection of meteorological data from a weather station, adjacent to or at the work area, in order to verify construction monitoring locations are appropriate based upon daily wind direction and wind speed, and;
- A QA/QC program.

All sampling, monitoring and analysis is to be completed in accordance with Ontario Ministry of Environment guidance, including:

- Operations Manual for Air Quality Monitoring in Ontario, Ministry of the Environment, Operations Division, Technical Support Section, March 2008, or as amended from time to time;

All sampling, monitoring and analysis should meet the regulatory requirements for air emissions under the Environmental Protection Act (EPA), and any applicable standards set out in Ontario Regulation 419/05- The Air Pollution-Local Air Quality Regulation for emissions from the work site. This includes the assessment of compliance with the standards, guidelines and upper risk thresholds that are outlined in SUMMARY of STANDARDS and GUIDELINES to support Ontario Regulation 419/05 - Air Pollution - Local Air Quality (including Schedule 6 of O. Reg. 419/05 on UPPER RISK THRESHOLDS).

The equipment and installation of on-site or adjacent meteorological equipment should conform to accepted practices as outlined in the Ministry document Operations Manual for Air Quality Monitoring in Ontario, 2008. The installation should include the capability to log data (wind speed, wind direction) with a time resolution of at least 5 minutes.

The expected sampling frequency and monitoring locations for the comprehensive air monitoring program are illustrated in Table 1 below. This program can be altered at the discretion of the Project Manager.

Table 1: Comprehensive Air Monitoring Program Sampling

Type of Sampling	Parameter	Location	Frequency
Real time monitoring	Readings for total VOCs or approved alternative	Five monitoring stations located along the site boundary and determined by project activity and weather conditions	Once per hour, using telemetry display available at site trailer
Verification sampling, 24 hour	VOCs*	At real time monitoring stations where verification is triggered, and simultaneously at an upwind location.	On an as needed basis triggered by real time exceedance of the real time monitoring criteria.
Weekly Sampling, 24 hour	VOCs*	At a location on site and downwind of project activities***	Once a week, to be collected at the same time as MOE measurements at adjacent

			HAMN stations.
Meteorological data	Wind Speed, Wind Direction	A weather station, adjacent to or at the work area.	Daily (log data with a time resolution of at least 5 minutes)

*expected VOC parameters to be defined by the air monitoring program and to include naphthalene
** For lower risk activities (i.e sheet pile driving) sampling frequencies may be reduced if the sampling program shows no air quality issues manifest during this time.
***Based upon daily meteorological data and weather forecast.

2. Develop an Odour Monitoring Program intended to address any odour issues should they arise.

a. The odour monitoring program would incorporate;
- Initial monitoring to establish baseline quantification of odour at an on-site location utilizing an odour quantifying technique such as an odour panel, olfactometer or equivalent;
- The establishment, with input and acceptance from the MOE, of an acceptable odour unit measurement to determine when odour issues have been resolved;
- On an as needed basis, determined by complaint, conduct monitoring to quantify odour (odour panel, olfactometer or equivalent) and collect a 30 minute air sample for VOC analysis at the; location of the receptor, an on-site location upwind from the receptor and downwind from the project activities, and a location upwind of project activities;
- The an example of the suggested sampling frequency and monitoring locations for the comprehensive air monitoring program are illustrated in Table 2 below;

Table 2 : Odour Monitoring Program Sampling

Type of Sampling	Parameter	Location	Frequency
Baseline odour monitoring	Quantification of odour (olfactometer, odour panel or equivalent)	At a location on site and downwind of project activities	Three times a week for the first week of any new in water project activity.
Receptor odour monitoring	Quantification of odour (olfactometer, odour panel or equivalent)	At the receptor site where the complaint was registered	One time sample collected on an as needed basis
Receptor 30 minute air sampling	VOCs*	At the receptor site where the complaint was registered	One time sample collected on an as needed basis
On-site odour monitoring	Quantification of odour (olfactometer, odour panel or equivalent)	At a location on site downwind of project activities and up wind from the receptor site where the complaint was registered	One time sample collected on an as needed basis and collected in conjunction with receptor odour monitoring
On-site 30 minute air sampling	VOCs*	At a location on site downwind of project activities and up wind from the receptor site where the complaint was registered	One time sample collected on an as needed basis and collected in conjunction with receptor 30 minute air sampling

*expected VOC parameters to be defined by the air monitoring program and to include naphthalene

3. Conduct regular air monitoring throughout the duration of the project as determined by the development of the Comprehensive Air Monitoring Program.

4. Provide a qualified and experienced technician to operate, maintain and calibrate the on-site project GCMS unit and associated equipment through the duration of the contract.

5. If required, conduct regular air monitoring throughout the duration of the project as determined by the development of the Odour Monitoring Program.

6. Compare analytical air sample results to the applicable AAQC, provide direction to the construction contractor accordingly and advise the departmental representative of any apparent issues.

7. Monitor and direct the activities of the construction contractor in order to minimize impacts on air quality. Alter or potentially suspend any project activities based real time air monitoring target exceedances (established to prevent an exceedance of an AAQC, where naphthalene has been noted as the parameter of the highest concern based on likely exceedance) and protective of health and safety concerns at the site boundary. Provide direction to the construction contractor and advice to the departmental representative related to the consideration of altering or suspending work related to odour issues. Noting that under the EPA, odour is considered to be a contaminant that may cause an adverse effect and will need to be addressed as applicable.

8. Provide assistance to the Departmental Representative with respect to any Quality Assurance/Quality Control audit monitoring required by the Departmental Representative and make any required changes based upon the results of the QA/QC audit monitoring.

9. Provide reporting of air quality measurements with the following frequency;

    a. Immediate upload and display of real time monitoring available at the construction engineer trailer;

b. Immediate notification to the departmental representative of the collection of verification sampling triggered by an exceedance of the real time monitoring criteria;
c. Weekly summary of the air quality monitoring results across that timeframe including the analytical results of VOC sampling and interpretation of the analytical results and their correlation to the continuous naphthalene monitoring;
d. A quarterly summary of all air monitoring activities and results;
e. A year summary of all air monitoring activities and results;
f. Final report summarizing the air quality monitoring conducted related to Stage I (ECF construction) of the project.

10. Allow for on-site meetings at the beginning of the construction contract, and if necessary during the contract, with Departmental Representative and Client to review and refine monitoring plan.

11. Adjust monitoring program to suit findings.

2.3.17 Construction Changes

1. The Consultant does not have authority to change the work or the price of the Contract.
2. Changes which affect cost or design concept must be approved by the Departmental Representative.
3. Upon Departmental Representative approval, obtain quotations from the Contractor in detail. Review prices and forward promptly recommendations to the Departmental Representative.
4. The Departmental Representative will issue Consultant-prepared Change Orders to the Contractor, with copy to Consultant.
5. All changes, including those not affecting the cost of the project, will be covered by Change Orders.
6. The practice of "trade offs" is not allowed.

2.3.18 Contractor's Progress Claims

1. Each month or at intervals agreed with the Contractor, the Contractor submits a progress claim for work and materials as required in the Construction Contract.
2. The claims are made by completing the following forms where applicable:
3. Request for Construction Payment
4. Cost Breakdown for Unit and/or combined Price Contract
5. Cost Breakdown for Fixed Price Contract
6. Statutory Declaration Progress Claim

7. Review and sign designated forms and promptly forward claims to the Departmental Representative for processing.
8. Submit with each progress claim:
9. Updated schedule of the progress of the work.
10. Photographs of the progress of the work.

2.3.19 Materials On Site

1. The Contractor may claim for payment of material on site but not incorporated in work.
2. Material must be stored in a secure place designated by the Departmental Representative.
3. Detailed list of materials with supplier's invoice showing price of each item must accompany claim; Consultant shall check and verify the list.
4. Items shall be listed separately on the Detail Sheet after the break-down list and total.
5. As material is incorporated in the work the cost must be added to the appropriate Detail item and removed from the material list.

2.3.20 Acceptance Board

Inform the Departmental Representative when satisfied that the project is substantially completed. The Consultant shall ensure that his representative, his sub-consultant representative, Resident On-Site Reviewer, Contractor and major sub-trades representatives shall form part of the Project Acceptance Board and attend all meetings as organized by the Departmental Representative.

2.3.21 Substantial Performance Inspection

The Acceptance Board shall inspect the work and list all unacceptable and incomplete work on a designated form. The Board shall accept the project from the Contractor subject to the deficiencies and uncompleted work listed and priced.

2.3.22 Certificates of Substantial Performance

1. Payment requires completion and signing, by the parties concerned, of the following documents:
    a. Certificate of Substantial Performance
    b. Cost Breakdown for Combined Price Contract
    c. Inspection and Acceptance
    d. Statutory Declaration Certificate of Substantial Performance

e. Workmen's Compensation Board Certificate.

2. Verify that all items are correctly stated and ensure that completed documents and any supporting documents are furnished to the Departmental Representative for processing.

2.3.23 Structure Occupation

1. The Departmental Representative or Client Department may occupy the structure after the date of acceptance of the structure by the Acceptance Board. The acceptance date is normally that of the Substantial Performance Certificate issued to the Contractor. As of the acceptance date, the Contractor may cancel the Contract Insurance, and the Departmental Representative or Client Department (as the case may be) assumes responsibility for:
   a. Security of the works.
   b. General maintenance and cleaning of the works.
   c. Maintenance of the site.

2.3.24 Final Inspection

Inform the Departmental Representative when satisfied that all work under the contract has been completed, including the deficiency items contained in the Inspection and Acceptance as a result of the Certificate of Substantial Performance. The Departmental Representative reconvenes the Acceptance Board which makes a final inspection of the project. If everything is satisfactory the Board makes final acceptance of the project from the Contractor.

2.3.25 Final Certificate

1. The final payment requires completion and signing, by the parties concerned, of the following documents:
   a. Final Certificate of Completion
   b. Inspection and Acceptance
   c. Statutory Declaration Final Certificate of Completion
   d. Cost Breakdown for Combined Price Contract
   e. Workmen's Compensation Clearance Certificate

2. Verify that all items are correctly stated and ensure that completed documents and any supporting documents are furnished to the Departmental Representative for processing.

2.3.26 Take-over

1. The official take-over of the project, or parts of the project, from the Contractor is established by the PWGSC Project Team which includes the Consultant and the Client Department. The date of Certificate of Substantial Performance and the Final Certificate of Completion signifies commencement of the 12 month warranty period for work completed on the date of each certificate in accordance with the General Conditions of the Contract.

2. Provide Departmental Representative with original copy of Contractor's warranties for all materials and work covered by an extended warranty or guarantee, according to the conditions of the specifications. Verify their completeness and extent of coverage.

2.3.27 As-Built and Record Drawings and Specifications

1. Following the take-over, obtain as-built marked-up hard copy from the Contractor:
2. Show significant deviations in construction from the original Contract drawings, including changes shown on Post-Contract Drawings, changes resulting from Change Orders or from On Site Instructions.
3. Check and verify all as-built records for completeness and accuracy and submit to PWGSC.
4. Produce Record Drawings by incorporating As-Built information into project drawings.
5. Submit Record Drawings and Specifications in number and format required by the Consultant Agreement within [8] weeks of final acceptance.
6. Provide a complete set of final shop drawings.
7. Close Out Report

2.4 DELIVERABLES:

1. Written reports from site visits including persons involved
2. Written reports on the progress of the work and the cost of the project at the end of each month
3. Review the updated project schedule to ensure that it reflects activity changes and completions, as well as activities in progress.
4. At each progress payment provide a narrative report identifying work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
5. The format of the report will be by approval of the Departmental Representative.

6. Additional detail drawings when required to clarify, interpret or supplement the Construction Documents
7. Post contract drawing
8. Interim or Final certificates
9. As built records
10. Warranty deficiency list
11 Report on Final Warranty Review
12 Close Out Report. The content includes:

CONTENTS OF CLOSE OUT REPORT (as a minimum)

Executive Summary

1 Introduction (including the purpose and Objective of Project)

2 Project Background

2.1 Site Description and History
- 2.1.1 Site Description
- 2.1.2 Site History

2.2 Physical Characteristics of Randle Reef
- 2.2.1 Bathymetry and Geophysical Information
- 2.2.2 Meteorology
- 2.2.3 Hydrology

2.3 Overview of the Hamilton Harbour AOC (including RAP/COA Objectives)

2.4 Sediment Characterization
- 2.4.1 Physical
- 2.4.2 Chemical

3 Project Implementation

3.1 Construction Design

3.2 Environmental Assessment

3.3 Tendering /Competitive Process

3.4 Construction Work plan / Program (as planned at the onset of the project)
- 3.4.1 Contract Schedule
- 3.4.2 Chronology of Events

Pre-Construction Activities
- 3.4.21 Preconstruction Meeting
- 3.4.22 Kick off Meeting
- 3.4.23 Site Preparation
- 3.4.24 Pre-Construction Inspections

3.4.3 Construction Phase

Figures
Tables
Appendices

RS 3 RESIDENT SITE SERVICES DURING CONSTRUCTION

3.1 Description of Services

The purpose of the Resident Site services is to ensure the presence of the Consultant's full-time representative on site to inspect, co-ordinate and monitor all aspects of the work during the construction of the facility, and liaise with the contractor, Public Works and Government Services Canada and other agencies as appropriate to the work. More than one person may be required to suit the hours of construction.

The Consultant Resident Site representative is responsible for providing full time (including overtime) resident inspection for all aspects of the project, maintaining daily records of all construction work placed and reporting.

The Resident Site representative shall:

1. be directly responsible to the Consultant.

2. become thoroughly familiar with the Contract documents (Stage 1 Design Drawings and Specifications (version 0)) , the National Building code and all Fire Commissioner of Canada Standards for Construction operations (incl. FCC No. 301 dated June 1982 and the Standard for Welding and Cutting FCC No. 302 dated June 1982). He shall also be aware of all Provincial and Municipal standards for the health and safety of construction workers.

3. become thoroughly familiar with the requirements of the Consultant Scope of Work and project responsibilities of others which relate to his services.

3.2 Specific Duties and Responsibilities

Provide full time resident inspection, co-ordination, monitoring and reporting during the construction work. In addition, the Departmental Representative may delegate additional responsibilities subject to Consultant’s agreement.

Maintain daily records of all construction work and ensure constant communication amongst PWGSC Project Manager, the Contractor, the appropriate PWGSC Departmental Representative and Consultants.

Co-ordinate and direct an assistant as approved by PWGSC.

In case of emergencies, the Resident Site representative is empowered to stop the work, or give orders to protect the safety of the workers or Crown property.

3.3 Inspection and Reporting

The Resident Site representative shall:

1. Inspect all phases of the work in progress, for the purpose of bringing to the attention of the Contractor any discrepancies between the work, the contract documents and accepted construction procedures,
2. Maintain a daily log of such inspections and shall issue a weekly written report to the Consultant, both for distribution, in the form directed,
3. Prepare any other reports or surveys as may be requested by the Departmental Representative through the Consultant,
4. Verify the quantities of materials received and record work progress.

3.4 Interpretation of the Contract Documents

Interpretation of the contract documents shall be the responsibility of the Consultant. The Consultant may, however, have the Resident Site representative provide him with information regarding job conditions and may require him to relay day-to-day instructions to the contractor.

It shall be the duty of the Resident Site representative to assist and further inform the Departmental Representative of any anticipated problems which may delay the progress of the work. The method of relaying such information shall be determined by the Consultant.

3.5 Changes in the Work

The Resident Site representative shall not authorize or order any change in the work which will constitute a change in design or in the value of the contract except as delegated by the Departmental Representative.

The Consultant may call upon the Resident Site representative to assist in the evaluation of changes in the work, where knowledge of job conditions is required.

3.6 Communication & Liaison

The Resident Site representative shall:

1. Convey the Consultant's instructions regarding the required standards of workmanship to the Contractor(s);
2. Refer to specifications, confer and obtain guidance on these findings with the Consultant. The matter is then to be brought to the attention of the Contractor's Superintendent. Although informal discussions with Sub-trade Superintendents are usually permissible, (but only with the agreement of the Contractor), the Resident Site representative should not deal directly with foreman or tradesmen, or interfere with the progress of the work.
3. Communicate formally with the contractor via memorandum form only. When this form is issued the Resident Site representative must immediately file copies with PWGSC and the Consultant.
4. Contact the Consultant immediately when it is apparent that information or action is required of the Consultant, e.g. general instructions, clarifications, sample of shop drawing approvals, requisitions, contemplated change orders, site instructions, details, drawings, etc.
5. Accompany PWGSC representatives on inspections and report to the Consultant requirements, comments or instructions of the PWGSC's forces. Note that the Resident Site representative should encourage such requirements, comments or instructions to be provided to him in writing.
6. Consider and evaluate any suggestions or modifications to the documents advanced by the Contractor and immediately report these to the Consultant with comments.
7. Ensure that PWGSC and the Consultant are notified promptly when key pieces and/or components of materials and equipment are delivered, so that these parties can arrange for the appropriate personnel to have an opportunity to inspect same prior to installation.

3.7 Daily Log

The Resident Site representative shall keep a daily log recording:

1. weather conditions, particularly unusual weather relative to construction activities in progress;
2. major material and equipment deliveries;
3. daily activities and major work done;
4. start, stop or completion of activities;
5. presence of inspection and testing firms, tests taken, results, etc;
6. unusual site conditions experienced;
7. significant developments, remarks, etc;
8. special visitors on site;
9. authorities given contractor to undertake certain or hazardous works
10. environmental incident
11. reports, instructions from appropriate authorities response actions.

Note: The log is the personal property of the Resident Site representative. Copies of the log book, certified as copies, are to be provided to PWGSC and consultant at the end of the project.

3.8 Weekly Records

The Resident Site representative shall prepare weekly reports for the Consultant in the form directed:

1. progress relative to schedule;
2. major activities commencing or completed during the week; main activities now in progress;
3. major deliveries of materials and/or equipment;
4. difficulties which may cause delays in completion;
5. materials and labour needed immediately;
6. cost estimates of work completed and materials delivered (if cost plus work is authorized);
7. outstanding information or action required by Consultant or PWGSC;
8. work force;
9. weather;
10. remarks;
11. accidents on site;
12 life safety or building hazards caused by the work, the contractor or his agents.

3.9 Site Records

The Resident Site representative shall maintain orderly and updated files at the site for the use of the PWGSC, Consultant and himself as follows:

1. Contract and Tender Documents.
2. Approved Shop Drawings.
3. Approved Samples.
4 Samples.
5. Site Instructions.
6. Contemplated Change Orders.
7. Change Orders.
8. Memoranda.
9. Test and Deficiency Reports.
10. Correspondence and Minutes of Meeting.

11. Names, addresses, telephone numbers of Client representatives, Consultant and all Contractors, sub-trades key personnel associated with the contract; including home telephone numbers in case of emergencies.
12. updated progress schedule.
13. A reproduction of the original contract drawings shall be carefully preserved and shall be kept marked up to date with all addenda, change orders, site instructions, details, as-built conditions, etc., issued subsequent to the award of the contract.

3.10 Inspection of the Work

The Resident Site representative shall make on site observations and spot checks of the work to determine whether the work, materials and equipment conform with the contract documents and supplementary conditions. The Site consultant's representative shall advise the Contractor of any deficiencies or unapproved deviations via memorandum and report immediately to the Consultant and PWGSC Construction Representative any of these on which the Contractor is tardy or refuses to correct.

The Resident Site representative shall arrange for the Consultant's, structural, mechanical, electrical and other consultants to make the periodic inspections required by the Consultant's contract, and for these inspections to be made timely with respect to the progress of the work.

The Resident Site representative shall also report if materials and equipment are being incorporated into the project, prior to approval of relative shop drawings or samples.

The Resident Site representative shall assist in the preparation of all deficiency reports, interim, preliminary, and final, in collaboration with the PWGSC and Consultant's representatives.

The Resident Site representative shall be responsible for the measurement of all work to be done on a unit-cost basis.

3.11 Site Meetings

The Resident Site representative shall attend all job-site meetings,

3.12 Inspection and Testing

The Resident Site representative must see that the tests and inspections required by the contract documents are conducted, and should observe these tests and report the results in the daily log.

The Consultant should be notified if the test results do not meet the specified requirements, or if the Contractor does not have tests undertaken as required.

3.13 Emergencies

In the case of emergency where safety of persons or property is concerned, or work is endangered by the actions of the contractor of the elements, to safeguard the interests of PWGSC, the Resident Site representative shall give immediate written notice to the Contractor of the possible hazard. He shall further, if necessary, stop the work or give orders for remedial work, and contact the Consultant immediately for further instruction.

3.14 Limitations

The Resident Site representative shall not:

1. Authorize deviations from the contract documents.
2. Conduct tests.
3. Approve shop drawings or samples.
4. Advise the user-client in any matter without obtaining guidance from the Consultant.
5. Accept any work or portions of the building.
6. Enter into the area of responsibility of the Contractor's Field Superintendent.
7. Stop the work unless convinced that an emergency exists as noted above.

3.15 Hazardous Construction Operations

It is the duty of the Resident Site representative to examine all site conditions and methods to be used by the Contractor undertaking hazardous operations.

Give written authority to undertake hazardous operations to the Contractor, when fully satisfied that all necessary precautions and acts have been taken by the Contractor to safeguard the life safety of the workers and building occupants and Crown property. Written authority shall be countersigned by the Contractor to acknowledge that the latter is aware of the Resident Site representative's instructions and requirements and both parties will retain copies of the authority document signed mutually by them.

The Resident Site representative shall inspect the areas where hazardous work is under way to ensure that the Contractor is maintaining the agreed safety standards. Any infractions may result in the Resident Site representative stopping the work. All infractions, or work stoppages ordered shall be reported in writing and verbally to the Consultant and PWGSC Construction Supervisor.

3.16 Site Security

Special precautions must be taken at all times to prevent unauthorized entry on to the site. The Resident Site representative will liaise closely with the Consultant and PWGSC Departmental Representative on all security and/or safety problems that may arise due to the contractor's operations. Furthermore, all personnel working on the site are to obtain a Port Security Access Card from the Hamilton Port Authority (HPA) ’s Port Security Centre.

OPTIONAL SERVICES (OS)

OS 1 BID EVALUATION & CONSTRUCTION CONTRACT AWARD

1.1 INTENT

If the overall schedule permits, evaluate bids from qualified contractors to construct the project as per the Tender Documents.

1.2 GENERAL

Scope and Activities:

1. Assist in tender evaluation by providing advice on the following:
   a. The completeness of tender documents in all respects.
   b. The technical aspects of the tenders.
   c. The effect of alternatives and qualifications which may have been included in the tender.
   d. The tenderers capability to undertake the full scope of work.
   e. The availability of adequate equipment to carry out the work.

2. If PWGSC decides to re-tender the project, provide advice and assistance to the Project Manager.
3. Examine and report on any cost and schedule impact created by the issue of tender/ contract addenda.

1.3 DELIVERABLES

Addenda where needed.

SUBMISSION REQUIREMENTS AND EVALUATION

SUBMISSION REQUIREMENT AND EVALUATION

SRE 1 GENERAL INFORMATION

1.1 Reference to the Selection Procedure

An 'Overview of the Selection Procedure' can be found in R1410T General Instructions to Proponents (GI3).

1.2 Calculation of Total Score

For this project the Total Score will be established as follows:

Technical Rating x 60%	=	Technical Score (Points)
Price Rating x 40%	=	Price Score (Points)
Total Score	=	Max. 100 Points

SRE 2 PROPOSAL REQUIREMENTS

2.1 Requirement for Proposal Format

The following proposal format information should be implemented when preparing the proposal.

- Submit one (1) bound original plus five (5) bound copies of the proposal
- Paper size should be - 216 mm x 279 mm (8.5" x 11")
- Minimum font size - 11 point Times or equal
- Minimum margins - 12 mm left, right, top, and bottom
- Double-sided submissions are preferred
- One (1) ‘page’ means one side of a 216 mm x 279 mm (8.5" x 11") sheet of paper
- 279 mm x 432 mm (11" x 17") fold-out sheets for spreadsheets, organization charts etc. will be counted as two pages.
- The order of the proposals should follow the order established in the Request for Proposal SRE section

2.2 Specific Requirements for Proposal Format

The maximum number of pages (including text and graphics) to be submitted for the Rated Requirements under SRE 3.2 is fifty (50) pages.

The following are not part of the page limitation mentioned above;

- Covering letter
- Table of Contents
- Tabs / Page Dividers (provided they are free of text and/or graphics)
- Consultant Team Identification (Appendix A)
- Declaration/Certifications Form (Appendix B)
- Code of Conduct Certifications (Appendix B- Annex BB)
- Front page of the RFP
- Front page of revision(s) to the RFP
- Price Proposal Form (Appendix C)

Consequence of non-compliance: any pages which extend beyond the above page limitation and any other attachments will be extracted from the proposal and will not be forwarded to the PWGSC Evaluation Board members for evaluation.

SRE 3 SUBMISSION REQUIREMENTS AND EVALUATION

3.1 MANDATORY REQUIREMENTS

Failure to meet the mandatory requirements will render the proposal as non-responsive and no further evaluation will be carried out.

3.1.1 Licensing, Certification or Authorization

The proponent shall be a civil engineering firm licensed, or eligible to be licensed, certified or otherwise authorized to provide the necessary professional services to the full extent that may be required by provincial or territorial law in the province of Ontario.

3.1.2 Consultant Team Identification

The consultant team to be identified must include the following:

Proponent (prime consultant) –	Civil Engineer
Key Sub-consultants / Specialists –	Marine Engineer
	Geotechnical Engineer
	Environmental Engineer/Specialist
	Air Quality Engineer / Specialist
	Bathymetric Surveying Expert
	Construction Techniques Expert
	Field Personnel for Monitoring

Information required - name of firm, key personnel to be assigned to the project. For the prime consultant indicate current license and/or how you intend to meet the provincial or territorial licensing requirements. In the case of a joint venture identify the existing or proposed legal form of the joint venture (refer to R1410T General Instructions to Proponents**,** GI9 Limitation of Submissions).

An example of an acceptable format (typical) for submission of the team identification information is provided in Appendix A.

3.1.3 Declaration/Certifications Form

Proponents must complete, sign and submit the following:

- Appendix B, Declaration/Certifications Form as required.

3.1.4 Code of Conduct Certifications

Proponents who are incorporated, including those bidding as a joint venture, must provide with their bid or promptly thereafter a complete list of names of all individuals who are currently directors of the Proponent. Proponents bidding as sole proprietorship, including those bidding as a joint venture, must provide the name of the owner with their bid or promptly thereafter. Proponents bidding as societies, firms, partnerships or associations of persons do not need to provide lists of names. If the required names have not been received by the time the evaluation of bids is completed, Canada will inform the Proponent of a time frame within which to provide the information. Failure to comply will render the bid non-responsive. Providing the required names is a mandatory requirement for contract award.

- Appendix “B” - Annex “BB”

3.2 RATED REQUIREMENTS

3.2.1 Achievements of Proponent, Sub-Consultants and Specialists on Projects

Describe the Proponent’s, Sub-consultants’ and Specialists’ accomplishments, achievements and experience as prime consultant on projects.

Select a **maximum** of six (6) projects (minimum of two (2) projects from the Proponent) undertaken within the last 6 years. The total aggregate number of projects submitted by the Proponent, Joint Venture and sub-consultants is not to exceed 6 projects.

Information that should be supplied:

- Clearly indicate how this project is comparable / relevant to the requested project.
- Brief project description and intent. Narratives should include a discussion of contract supervision including evaluations of contractor methodology, environmental plan and site safety plan.
- Supervision approach for ensuring that the delivery of the project is in compliance with the contract documents, including site supervision, environmental monitoring, reporting and close out reports.
- Budget control and management - i.e. contract price & final construction cost - explain variation
- Project schedule control and management - i.e. initial schedule and revised schedule - explain variation
- Client references - name, address, phone and fax of client contact at working level - references may be checked
- Awards received

3.2.2 Achievements of Key Personnel on Projects

Describe the experience and performance of key personnel to be assigned to this project regardless of their past association with the current proponent firm. This is the opportunity to emphasize the strengths of the individuals on the team, to recognize their past responsibilities, commitments and achievements.

Information that should be supplied for each key personnel:

- Names of key personnel responsible for project delivery and Curriculum Vitae (CV)
- Professional accreditation
- Accomplishments/achievements/awards
- Relevant experience, expertise, number of years experience
- Role, responsibility and degree of involvement of individual in past projects

3.2.3 Understanding of the Project:

The proponent should demonstrate understanding of the goals of the project, the functional/technical requirements, the constraints and the issues that will shape the end product.

Information that should be supplied:

- The functional and technical requirements
- Broader goals (federal image, sustainable development, sensitivities)

- The relationship between this commission and any earlier work completed for PWGSC
- Significant issues, challenges and constraints
- Project schedule and cost. Review schedule and cost information and assess risk management elements that may affect the project

3.2.4 Management of Services:

The Proponent should describe how he /she proposes to perform the services and meet the constraints; how the services will be managed to ensure continuing and consistent control as well as production and communication efficiency; how the team will be organized and how it will fit in the existing structure of the firms; and how the team will be managed. The proponent is also to identify sub-consultant disciplines and specialists required to complete the consultant team.
If the Proponent proposes to provide multi-disciplinary services which might otherwise be performed by a sub-consultant, this should be reflected here.

Information that should be supplied:

- Confirm the makeup of the full project team including the names of the consultant sub-consultants and specialist's personnel and their role on the project.
- Organization chart with position titles and names (Consultant team). Joint Venture business plan, team structure and responsibilities, if applicable
- What back-up personnel will be committed
- Profiles of the key positions (specific assignments and responsibilities)
- Outline of an action plan of the services with implementation strategies and sequence of main activities
- Reporting relationships
- Communication strategies

  Response time: demonstrate how the response time requirements will be met

3.2.5 Construction Supervision Philosophy / Approach / Methodology

The proponent should elaborate on aspects of the project considered to be a major challenge which will illustrate philosophy / approach / methodology. This is the opportunity for the Proponent to state the overall philosophy of the team as well as their approach of resolving construction issues and in particular to focus on the unique aspects of the current project.

Information that should be supplied:

- Construction Supervision Philosophy / Approach / Methodology
- Describe the major challenges and how your team approach will be applied to those particular challenges.

3.3 EVALUATION AND RATING

In the first instance, price envelopes will remain sealed and only the technical components of the proposals which are responsive will be reviewed, evaluated and rated by a PWGSC Evaluation Board in accordance with the following to establish Technical Ratings:

Criterion	Weight Factor	Rating	Weighted Rating
Achievements of Proponent, Sub-consultants and Specialists on Projects	3.0	0 - 10	0 - 30
Achievements of Key Personnel on Projects	3.0	0 - 10	0 - 30
Understanding of the Project	0.5	0 - 10	0 - 5
Management of Services	0.5	0 - 10	0 - 5
Construction Supervision Philosophy / Approach / Methodology	3.0	0 - 10	0 - 30
Technical Rating	10.0		0 - 100

Generic Evaluation Table
PWGSC Evaluation Board members will evaluate the strengths and weaknesses of the Proponent's response to the evaluation criteria and will rate each criterion with even numbers (0, 2, 4, 6, 8 or 10) using the generic evaluation table below:

	INADEQUATE	WEAK	ADEQUATE	FULLY SATISFACTORY	STRONG
0 point	2 points	4 points	6 points	8 points	10 points
Did not submit information which could be evaluated	Lacks complete or almost complete understanding of the requirements.	Has some understanding of the requirements but lacks adequate understanding in some areas of the requirements.	Demonstrates a good understanding of the requirements.	Demonstrates a very good understanding of the requirements.	Demonstrates an excellent understanding of the requirements.
	Weaknesses cannot be corrected	Generally doubtful that weaknesses can be corrected	Weaknesses can be corrected	No significant weaknesses	No apparent weaknesses
	Proponent do not possess qualifications and experience	Proponent lacks qualifications and experience	Proponent has an acceptable level of qualifications and experience	Proponent is qualified and experienced	Proponent is highly qualified and experienced
	Team proposed is not likely able to meet requirements	Team does not cover all components or overall experience is weak	Team covers most components and will likely meet requirements	Team covers all components - some members have worked successfully together	Strong team - has worked successfully together on comparable projects
	Sample projects not related to this requirement	Sample projects generally not related to this requirement	Sample projects generally related to this requirement	Sample projects directly related to this requirement	Leads in sample projects directly related to this requirement
	Extremely poor, insufficient to meet performance requirements	Little capability to meet performance requirements	Acceptable capability, should ensure adequate results	Satisfactory capability, should ensure effective results	Superior capability, should ensure very effective results

To be considered further, proponents **must** achieve a minimum Technical Rating of seventy (70) points out of the hundred (100) points available as specified above.

No further consideration will be given to proponents not achieving the pass mark of seventy (70) points.

SRE 4 PRICE OF SERVICES

All price proposal envelopes corresponding to responsive proposals which have achieved the pass mark of seventy (70) points will be opened upon completion of the technical evaluation. An average price is determined by adding all the price proposals together and dividing the total by the number of price proposals being opened.

All price proposals which are greater than twenty-five percent (25%) above the average price will be set aside and receive no further consideration.

The remaining price proposals are rated as follows:

1. The lowest price proposal receives a Price Rating/maximum Score of 40;

2. Other price proposals will receive a Score based on the following formula:

$$\frac{\text{Lowest Price Proposal}}{\text{Proponent Price Proposal}} \times 40 \text{ points} = \text{Price Rating/Score}$$

.

SRE 5 TOTAL SCORE

Total Scores will be established in accordance with the following:

Rating	Possible Range	% of Total Score	Score (Points)
Technical Rating	70 - 100	60	42 - 60
Price Rating	0 - 100	40	0 - 40
Total Score		100	0 - 100

The Proponent receiving the highest Total Score is the first entity that the Evaluation Board will recommend for the provision of the required services. In the case of a tie, the proponent submitting the lower price for the services will be selected.

SRE 6 SUBMISSION REQUIREMENTS - CHECKLIST

The following list of documents and forms is provided with the intention of assisting the Proponent in ensuring a complete submission. The Proponent is responsible for meeting all submission requirements.
Please follow detailed instructions in R1410T General Instructions to Proponents**,** GI16 Submission of Proposal. Proponents may choose to introduce their submissions with a cover letter.

☐Team Identification	-see typical format in Appendix A
☐ Declaration / Certification	-completed and signed form(s) - form(s) provided in Appendix B
☐ Code of Conduct Certifications	- list of directors, see Appendix B -Annex BB
☐ Proposal	-one (1) signed original plus four (4) bound copies
☐ Front page of RFP	-completed and signed
☐ Front page(s) of any solicitation amendment	-completed and signed

In a separate envelope:

☐ Price Proposal form	- one (1) completed, signed and submitted in a separate envelope

APPENDIX A

Team Identification Format

APPENDIX A - TEAM IDENTIFICATION FORMAT

For details on this format, please see SRE in the Request For Proposal.

The prime consultant and other members of the Consultant Team shall be, or eligible to be, licensed, certified or otherwise authorized to provide the necessary professional services to the full extent that may be required by provincial or territorial law.

I. Prime Consultant (Proponent): Civil Engineer

Firm or Joint Venture Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

II. A. Key Sub Consultants / Specialists: Marine Engineer

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

B. Key Sub Consultants / Specialists: Geotechnical Engineer

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

C. Key Sub Consultants / Specialists: Environmental Engineer/Specialist

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

D. Key Sub Consultants / Specialists: Air Quality Engineer/Specialist

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

E. Key Sub Consultants / Specialists: Bathymetric Surveying Expert

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

F. Key Sub Consultants / Specialists: Construction Techniques Expert

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

G. Key Sub Consultants / Specialists: Field Personnel for Monitoring

Firm Name: .....
.....
.....

Key Individuals and provincial professional licensing status and/or professional accreditation:

.....
.....
.....
.....
.....

APPENDIX B

DECLARATION/CERTIFICATIONS FORM

APPENDIX B - DECLARATION/CERTIFICATIONS FORM

Project Title:

Name of Proponent:

Street Address: **Mailing Address:**

Telephone Number:( )

Fax Number: ( )

E-Mail:

Procurement Business Number:

Type of Organization:	**Size of Organization:**
_____ Sole Proprietorship _____ Partnership _____ Corporation _____ Joint Venture	Number of Employees _____ Graduate Architects / Professional Engineers _____ Other Professionals _____ Technical Support _____ Other _____

APPENDIX B - DECLARATION/CERTIFICATIONS FORM (CONT'D)

Federal Contractors Program for Employment Equity - Certification

I, the Proponent, by submitting the present information to the Contracting Authority, certify that the information provided is true as of the date indicated below. The certifications provided to Canada are subject to verification at all times. I understand that Canada will declare a proposal non-responsive, or will declare a consultant in default, if a certification is found to be untrue, whether during the proposal evaluation period or during the contract period. Canada will have the right to ask for additional information to verify the Proponent's certifications. Failure to comply with such request by Canada will also render the proposal non-responsive or will constitute a default under the contract.

For further information on the Federal Contractors Program for Employment Equity visit HRSDC-Labour's website.

Date:_____(YY/MM/DD) (If left blank, the date will be deemed to be the bid closing date.)

Complete both A and B.

A. Check only one of the following:

( ) A1. The Proponent certifies having no work force in Canada.

( ) A2. The Proponent certifies being a public sector employer.

( ) A3. The Proponent certifies being a federally regulated employer being subject to the *Employment Equity Act*.

( ) A4. The Proponent certifies having a combined work force in Canada of less than 100 employees (combined work force includes: permanent full-time, permanent part-time and temporary employees [temporary employees only includes those who have worked 12 weeks or more during a calendar year and who are not full-time students]).

A5. The Proponent has a combined work force in Canada of 100 or more employees; and

APPENDIX B - DECLARATION/CERTIFICATIONS FORM (CONT'D)

( ) A5.1. The Proponent certifies already having a valid and current Agreement to Implement Employment Equity (AIEE) in place with HRSDC-Labour.

OR

( ) A5.2. The Proponent certifies having submitted the Agreement to Implement Employment Equity (LAB1168) to HRSDC-Labour. As this is a condition to contract award, proceed to completing the form Agreement to Implement Employment Equity (LAB1168), duly signing it, and transmit it to HRSDC-Labour.

B. Check only one of the following:

( ) B1. The Proponent is not a Joint Venture.

OR

( ) B2. The Proponent is a Joint Venture and each member of the Joint Venture must provide the Contracting Authority with a completed Federal Contractors Program for Employment Equity - Certification. (Refer to the Joint Venture section of the General Instructions to Proponents)

APPENDIX B - DECLARATION/CERTIFICATIONS FORM (CONT'D)

Former Public Servant (FPS) - Certification

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts with FPS, proponents must provide the information required below before contract award.

Definitions

For the purposes of this clause,

"former public servant" is any former member of a department as defined in the *Financial Administration Act*, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

(a) an individual;
(b) an individual who has incorporated;
(c) a partnership made of former public servants; or
(d) a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the *Public Service Superannuation Act* (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the *Supplementary Retirement Benefits Act*, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the *Canadian Forces Superannuation Act*, R.S., 1985, c.C-17, the *Defence Services Pension Continuation Act*, 1970, c.D-3, the *Royal Canadian Mounted Police Pension Continuation Act*, 1970, c.R-10, and the *Royal Canadian Mounted Police Superannuation Act*, R.S., 1985, c.R-11, the *Members of Parliament Retiring Allowances Act*, R.S., 1985, c.M-5, and that portion of pension payable to the *Canada Pension Plan Act*, R.S., 1985, c.C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Proponent a FPS in receipt of a pension?
YES ( ) NO ( )

APPENDIX B - DECLARATION/CERTIFICATIONS FORM (CONT'D)

If so, the Proponent must provide the following information, for all FPS in receipt of a pension, as applicable:

(a) name of former public servant;
(b) date of termination of employment or retirement from the Public Service.

By providing this information, proponents agree that the successful Proponent's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Proponent a FPS who received a lump sum payment pursuant to the terms of a work force reduction program? YES ( ) NO ( )

If so, the Proponent must provide the following information:

(a) name of former public servant;
(b) conditions of the lump sum payment incentive;
(c) date of termination of employment;
(d) amount of lump sum payment;
(e) rate of pay on which lump sum payment is based;
(f) period of lump sum payment including start date, end date and number of weeks;
(g) number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is $5,000, including Applicable Taxes.

APPENDIX B - DECLARATION/CERTIFICATIONS FORM (CONT'D)

Name of Proponent:

DECLARATION:
I, the undersigned, being a principal of the proponent, hereby certify that the information given on this form and in the attached proposal is accurate to the best of my knowledge. If any proposal is submitted by a partnership or joint venture, then the following is required from each component entity.

.....
.....
name signature

.....
title
I have authority to bind the Corporation / Partnership / Sole Proprietorship / Joint Venture

.....
.....
name signature

.....
title
I have authority to bind the Corporation / Partnership / Sole Proprietorship / Joint Venture

.....
.....
name signature

.....
title
I have authority to bind the Corporation / Partnership / Sole Proprietorship / Joint Venture

During proposal evaluation period, PWGSC contact will be with the following person:_____.

Telephone Number: ( ) _____ Fax Number: ( ) _____

E-mail: _____

This Appendix "B" should be completed and submitted with the proposal, but may be submitted afterwards as follows: if Appendix "B" is not completed and submitted with the proposal, the Contracting Authority will so inform the Proponent and provide the Proponent with a time frame within which to meet the requirement. Failure to comply with the request of the Contracting Authority and meet the requirement within that time period will render the proposal non-responsive.

APPENDIX B

ANNEX BB

CODE OF CONDUCT CERTIFICATIONS

Proponents who are incorporated, including those bidding as a joint venture, must provide with their bid or promptly thereafter a complete list of names of all individuals who are currently directors of the Proponent. Proponents bidding as sole proprietorship, including those bidding as a joint venture, must provide the name of the owner with their bid or promptly thereafter. Proponents bidding as societies, firms, partnerships or associations of persons do not need to provide lists of names. If the required names have not been received by the time the evaluation of bids is completed, Canada will inform the Proponent of a time frame within which to provide the information. Failure to comply will render the bid non-responsive. Providing the required names is a mandatory requirement for contract award

APPENDIX C

Price Proposal Form

APPENDIX C - PRICE PROPOSAL FORM

INSTRUCTIONS: Complete this Price Proposal Form and submit in a **separate sealed envelope** with the Name of Proponent, Name of Project, PWGSC Solicitation Number, and the words "PRICE PROPOSAL FORM" typed on the outside of the envelope. Price Proposals are not to include Applicable Taxes.

PROPONENTS SHALL NOT ALTER THIS FORM

Project Title: **Randle Reef - Sediment Remediation: Stage 1 - Construction Engineering Services**

Name of Proponent: _____

The following will form part of the evaluation process:

REQUIRED SERVICES

- **A. Fixed Fee** (R1230D (2012-07-16), GC 5 - Terms of Payment)

SERVICES	FIXED FEE
RS 1 Analysis of Project Requirements	$.....
MAXIMUM FIXED FEES	**$.....**

- **B. Time Based Fees** (R1230D (2012-07-16), GC 5 - Terms of Payment)

Notes:

1. The cost for these services shall be based on the Fixed Hourly Rates identified below for the duration of the Contract. The rates must be inclusive of overhead and profit and excluding HST. 2. Construction period is based on an estimated 100 weeks.

3. No information is to be added to, or deleted from this form and all required prices must be filled in on the form. There shall be no “not applicable” or blank price items, or the proposal will be declared non-responsive and set aside, receiving no further consideration.

4. Payment will be based on actual hours spent. Travel time, accomodations and/or expenses will not be reimbursed separately.

5. All inclusive hourly rate is applicable to both normal working hours and any other shift work as required**.**

RS 2 Construction and Contract Administration

Position	Name	Fixed Hourly Rate ($/hr)	Estimated Hrs	Total Amount $ (Estimated)
Project Director			300	
Civil/Marine Engineer			4,000	
Construction Techniques Expert 1			500	
Environmental Engineer/Scientist Engineer			500	
Air Quality Engineer/Scientist			300	
Construction Techniques Expert 2			300	
Records, CADD and Reporting Technician Assistance			2,000	
Administration Support Clerk			1,000	
RS 2 TOTAL				

RS 3 Resident Site Services During Construction				
Position	**Name**	**Fixed Hourly Rate ($/hr)**	**Estimated Hrs**	**Total Amount $ (Estimated)**
Resident Inspector 1			4,000	
Resident Inspector 2			4,000	
Testing Monitoring Technician			2,000	
Site Data Processing Technician			4,000	
RS 3 TOTAL				

SERVICES	TIME BASED FEE
RS 2 Construction and Contract Administration	$.....
RS 3 Resident Site Services During Construction	$.....
MAXIMUM TIME BASED FEES	**$.....**

OPTIONAL SERVICE

- **C. Time Based Fees** (R1230D (2012-07-16), GC 5 - Terms of Payment)

OS 1 BID EVALUATION & CONSTRUCTION CONTRACT AWARD				
Position	**Name**	**Fixed Hourly Rate ($/hr)**	**Estimated Hrs**	**Total Amount $ (Estimated)**
Project Director			5	
Civil/Marine Engineer			60	
Environmental Engineer/Scientist Engineer			10	
Construction Techniques Expert			20	
Administration Support Clerk			5	
OS 1 TOTAL				

OPTIONAL SERVICES — TIME BASED FEE

OS 1 Bid Evaluation & Construction Contract Award — $.....

MAXIMUM TIME BASED FEES — $.....

- **D. Disbursements** (R1230D (2012-07-16), GC 5 - Terms of Payment, GC5.12 Disbursements)

Laboratory Testing and Materials, Site Testing Equipment not supplied by PWGSC, Lab Testing and Site Testing Consumables and Storage Facilities.

All Equipment purchased by Consultant are to be handed

over to PWGSC after completion of contract $ 200,000.00*

MAXIMUM ALLOWABLE DISBURSEMENTS $200,000.00

** All Proponents are to carry this amount for Price Proposal Evaluation purposes.*

TOTAL COST OF SERVICES FOR PROPOSAL EVALUATION PURPOSES

A. Maximum Fixed Fees - RS 1 $.....

B. Maximum Time Based Fees - RS 2 and RS 3 $.....

C. Maximum Time Based Fees - OS 1 $.....

D. Maximum Allowable Disbursements $ 200,000.00

Total Evaluated Fee $.....

END OF PRICE PROPOSAL FORM

APPENDIX D

EXISTING DOCUMENTATION

(refer to PD4 Existing Documentation)

APPENDIX E

Schedule

RANDLE REEF - STAGE 1 CONSTRUCTION SCHEDULE

Schedule is approximate and may vary

Construction Engineering Consultant - Award	Mar-14
Construction Stage 1 - Tender Review	Mar-14
Construction Stage 1 - Award	Mar-14
Raw Steel Production (US Steel)	Feb-14
Steel Fabrication	Apr-14
On-Site Mobilization	Apr-14
On-Site Construction Stage 1 - Start	May-14
Construction Stage 1 - Completion	Apr-16

Appendix F

Proposed Work Management Decision Criteria for Sydney Tar Ponds and Coke Ovens Clean Up Project Benzene & Naphthalene

PROPOSED WORK MANAGEMENT DECISION CRITERIA FOR SYDNEY TAR PONDS AND COKE OVENS CLEAN UP PROJECT
BENZENE & NAPHTHALENE

I. INTRODUCTION

AMEC has been requested to derive two sets of health-protective criteria for volatile organic chemicals, specifically benzene and naphthalene, for use with the Air Quality Monitoring Programme associated with the Sydney Tar Ponds Clean Up Project. These include criteria for laboratory data collected from 24-hour sample collection devices located in the residential communities surrounding the site and criteria for real-time fence line photoionization detector (PID) air quality monitoring instruments (PID meters) that will be used to determine if and when work activities must be ceased to ensure that public health is protected.

Regulatory authorities are aware that regulatory toxicological criteria, such as Reference Concentrations, Minimum Risk Levels, Tolerable Concentrations, etc. are all derived in a very conservative manner with the application of multiple levels of safety factors. They represent values that are without appreciable risk of adverse health effects, but they are much, much lower than are actually required to protect human health. The community criteria proposed here for comparison to laboratory data from 24-hour community monitoring samples are derived with the full use of these regulatory safety factors. Such criteria are not to be applied on a sample-by-sample basis for a 24-hour sample or samples of shorter durations. They must be compared to community monitoring sample data averaged to match the averaging times specified in the regulatory documentation for the criteria. Specifically, the community criteria proposed in this document for benzene and naphthalene must be applied using a 365-day averaging time.

The fence line Stop Work criteria proposed here to govern the conduct of daily work activities during the clean up project are defined with the full use of regulatory safety factors. As such they are derived from No Observed Adverse Effect Levels and not Lowest Observed Adverse Effect Levels. In addition, this document demonstrates what those fence line Stop Work criteria would be if they were derived based on concentrations that are associated with potential toxicological effects. This is provided in this document because regulatory authorities are interested knowing constituent levels might *actually* cause health effects in exposed individuals. Comparing the fence line Stop Work criteria that are based on No Observed Adverse Effect Levels in humans with the addition of standard safety factors to protect sensitive individuals in the human population (which are the criteria proposed for use with the monitoring programme) to similarly derived criteria that are derived based on Lowest Observed Adverse Effect Levels with the addition of standard safety factors to protect sensitive individuals in the human population (show here for illustrative purposes only) demonstrates that the criteria proposed here are more than adequately protective of human health.

This document assumes that the PID air quality monitoring instruments for real-time fence line monitoring are calibrated against isobutylene and use a lamp with a correction factor (CF) of 0.6 for benzene and 0.45 for naphthalene. If the PID meters are calibrated directly against benzene or the benzene CF is programmed into the PID meter, then the criteria shown in this document should be multiplied by 0.6 to convert the PID criteria to

"benzene" criteria rather than "PID" criteria assuming the presence of benzene. Similarly, a CF of 0.45 is used for naphthalene.

The following is a summary of the criteria derived in this document and proposed for use with the Air Quality Monitoring Programme associated with the Sydney Tar Ponds Clean Up Project. Although there are two Stop Work criteria derived, one based on benzene and one based on naphthalene, the lower of the two must govern the program because the PID meters cannot identify the source of instrument reading. Thus, this document proposes a running daily total of 8 ppm assuming two 15-minute reading every hour at a downwind fence line location as the daily Stop Work criterion. This running total of 8 ppm is location-dependent. If the wind is blowing towards fence line monitoring location #1 for four hours and then the wind shifts to fence line monitoring location #2 for the remainder of the day, the running total for location #1 is stopped and a new running total is initiated for location #2.

SUMMARY OF CRITERIA

Real-Time Fence Line Monitors

Criteria Type	**Criteria for 15-Minute Fence Line Monitors (Real Time Data)**
Stop Work (PID)	Running daily total of 12 ppm (assuming presence of benzene)
Stop Work (PID)	Running daily total of 8 ppm* (assuming presence of naphthalene) or add the MOE #

* Note that 8 ppm is defined as the Stop Work criterion.

24-Hour Community Monitors

Criteria Type	**Criteria for 24-hour Community Monitors (Laboratory Data)**
Benzene	Calendar Year Annual Average: 10 µg/m^3
Naphthalene	Calendar Year Annual Average: 3 µg/m^3

II. BENZENE STOP WORK CRITERIA

A. Summary of Published Toxicological Criteria For Benzene

1. Acute Toxicity

(a) 14-Day Acute ATSDR MRL
MRL = 29 µg/m^3
Endpoint = Immunotoxicity
LOAEL = 10.2 ppm (6 day study)
Human Adjusted LOAEL = 2.55 ppm
Composite Safety Factor = 300
Safety Factors:
3 Animal to Human
10 Human Variability
10 LOAEL to NOAEL

Effect Levels
Effect Level in Average Humans: 2.55 ppm/3 = 0.85 ppm = 2,874 µg/m^3
Effect Level in Most Sensitive Humans: 0.85 ppm/10 = 0.085 ppm (290 µg/m^3)

No Effect Levels
No effect Level in Most Sensitive Humans: 0.085 ppm/10 = 0.0085 ppm (29 µg/m^3)

(b) Acute California REL
1300 µg/m^3 for 6 hours
LOAEL = 100 ppm
NOAEL = 40 ppm
Reproductive /developmental
NOAEL 40 ppm
Composite Safety Factor: 100
Safety Factors:
10 Animal to human
10 Human variability

Effect Levels
Effect Level in Humans: 100 ppm/10 = 10 ppm = 32,000 µg/m^3
Effect Level in Most Sensitive Humans: 32,000 µg/m^3 /10 = 3,200 µg/m^3

No Effect Levels
No Effect Level in Average Humans: 40 ppm/10 = 4 ppm (12,800 µg/m^3)
No Effect Level in Most Sensitive Humans: 4 ppm/10 = 0.4 ppm (1,280 µg/m^3)

(c) American Industrial Hygiene Association Emergency Response Planning Guidelines (ERPGs)

ERPG 1 (60 minutes)
50 ppm = 160,000 µg/m^3 (nearly all people exposed for an hour would experience no effects other than transient effects)
ERPG 2 (60 minutes)
150 ppm = 479,000 µg/m^3 (nearly all people exposed for an hour would not experience irreversible or life-threatening effects that could impair their ability to take protective action)
ERPG 3 (60 minutes)
1000 ppm = 3,190,000 µg/m^3 (nearly all people exposed for an hour would not experience life-threatening effects)

(d) U.S. EPA/National Academy of Sciences Acute Exposure Guideline Levels (AEGLs)

AEGL 1 (10 Minutes) 130 ppm = 415,000 µg/m^3
AEGL 2 (10 Minutes) 2,000 ppm = 6,387,000 µg/m^3
AEGL 3 (10 Minutes) NA

AEGL 1 (30 Minutes) 73 ppm = 233,000 µg/m^3
AEGL 2 (30 Minutes) 1,100 ppm = 3,513,000 µg/m^3
AEGL 3 (30 Minutes) 5,600 ppm = 17,883,000 µg/m^3

3. Subchronic/Chronic Toxicity

(a) Intermediate ATSDR MRL (14-365 days)
MRL = 19 µg/m^3
Endpoint = Immunological effects
LOAEL = 10 ppm
Human Adjusted LOAEL = 1.8 ppm
Composite Safety Factor = 300
Safety Factors:
3 Animal to Human
10 Human Variability
10 LOAEL to NOAEL

Effect Levels
Effect level in average humans = 1.8/3 = 0.6 ppm = 1,916 µg/m^3
Effect level in most sensitive humans = 1,916/10 = 192 µg/m^3 (~190 µg/m^3)

No Effect Levels
No effect level in most sensitive humans = 192 µg/m^3 /10 = 19.2 µg/m^3 (~190 µg/m^3)

(b) Chronic ATSDR MRL (>365 days)
MRL = 10 µg/m^3
Endpoint = Immunological effects
Benchmark Dose = 0.1 ppm
Human Benchmark Dose = 0.03 ppm

Composite Safety Factor = 10
Safety Factors:
10 Human Variability

Effect Levels
Effect level in average humans = 0.03 ppm = 96 µg/m^3
Effect level in most sensitive humans = 96/10 = 9.6 µg/m^3 (~10 µg/m^3)

(c) Chronic EPA RfC (lifetime)
RfC = 30 µg/m^3
Endpoint = Immunological effects
BMCL 8,200 µg/m^3 (LOAEL) (human data)
Composite Safety Factor = 300
Safety Factors:
3 Subchronic to chronic (not used here because exposures are subchronic)
3 Database deficiencies
10 Human variability
3 LOAEL to NOAEL

Effect Levels
Average Human Effect Level: 8,200 µg/m^3 subchronic exposure
Sensitive Human Effect Level: 8200/10 = 820 µg/m^3 subchronic exposure

No Effect Levels
Average Human No Effect Level: 8,200 µg/m^3 / 9 = 911 µg/m^3 subchronic exposure
Sensitive Human No Effect Level: = 911 µg/m^3 / 10 = 91 µg/m^3 subchronic exposure

(d) Chronic CA REL (lifetime)
REL = 60 µg/m^3
Endpoint = hematological effects
NOAEL = 0.19 ppm humans
Composite Safety Factor = 10
Safety Factors:
10 Human variability

Effect Levels
Effect level in average humans = >0.19 ppm = >610 µg/m^3
Effect level in most sensitive humans = >610/10 = >61 µg/m^3

No Effect Levels
No Effect level in average humans = 0.19 ppm (610 µg/m^3)
No Effect level in most sensitive humans = 0.19 ppm / 10 = 0.019 ppm (61 µg/m^3)

(e) OSHA PEL (working lifetime)
PEL = 32,000 µg/m^3

(f) ACGIH TLV (working lifetime)
TLV = 1,600 µg/m^3

(g) Health Canada (2004) Inhalation Slope Factor from TC_{05} = 1.46E-02 $(mg/kg\text{-}d)^{-1}$

$1x10^{-5}$ Risk-Specific Concentration for 5 years: 48 $\mu g/m^3$
$1x10^{-5}$ Risk-Specific Concentration for 10 years: 24 $\mu g/m^3$

B. Derivation of Toxicological Criteria Based on Acute Toxicological Effects for Use in Deriving Real-Time Fence Line Stop Work Criteria For Benzene

No acute effects would be expected of any type in the *average* person unless exposure levels were in the range of >415,000 $\mu g/m^3$ for 10 minutes, >233,000 $\mu g/m^3$ for 30 minutes, >160,000 $\mu g/m^3$ for 60 minutes, >32,000 $\mu g/m^3$ for six hours, or >2,900 $\mu g/m^3$ for 336 hours (14 days). In the *most sensitive* humans, no acute effects would be expected of any type unless exposure levels were in the range of 415,000 $\mu g/m^3$ for 10 minutes, 233,000 $\mu g/m^3$ for 30 minutes, 160,000 $\mu g/m^3$ for 60 minutes, 3,200 $\mu g/m^3$ for six hours, or 290 $\mu g/m^3$ for 336 hours (14 days).

TABLE 1
SUMMARY OF ACUTE EFFECT LEVELS IN HUMANS FOR BENZENE

Criterion	Exposure / Averaging Time	Source
>415,000 $\mu g/m^3$	10 minutes	AEGL 1 (estimated transient effect level in average people)
>233,000 $\mu g/m^3$	30 minutes	AEGL 1 (estimated transient effect level in average people)
>160,000 $\mu g/m^3$	60 minutes	ERPG 1 (estimated transient effect level in average people)
32,000 $\mu g/m^3$	6 hours	Acute California REL (effect level in average people)
2,900 $\mu g/m^3$	14 days	Acute ATSDR MRL (effect level in average people)
415,000 $\mu g/m^3$	10 minutes	AEGL 1 (effect level in *sensitive* people)
233,000 $\mu g/m^3$	30 minutes	AEGL 1 (effect level in *sensitive* people)
160,000 $\mu g/m^3$	60 minutes	ERPG 1 (transient effect level in sensitive people)
3,200 $\mu g/m^3$	6 hours	Acute California REL (effect level in *sensitive* people)
290 $\mu g/m^3$	14 days	Acute ATSDR MRL (effect level in *sensitive* people)
2,135 $\mu g/m^3$	1 day	Derived from Acute ATSDR MRL (effect level in *sensitive* people)*

* See text

(a) AEGLs and ERPGs

It is thus proposed that a Stop Work criterion for the real-time monitors to protect against acute toxicological effects in members of the community could be set using community concentrations as high as 233,000 - 415,000 µg/m^3 because EPA's AEGLs for 10 and 30 minutes are in this range. However, to take into consideration the fact that a high reading above any criterion could be preceded by other high readings, albeit lower than the criterion, another reasonable fence line "Stop Work" criterion to protect against acute toxicological effects could be based on the ERPG-1 value of 160,000 µg/m^3 in the community. This one-hour acute toxicological criterion would be applied to a 15-minute exposure period as a conservative measure.

Other Stop Work criterion for the real-time monitors to protect against acute toxicological effects in members of the community could be derived based on the other acute toxicological criteria for benzene that are applicable for averaging times greater than 60 minutes. Specifically, the effect level in sensitive humans associated with the California Acute REL is 3,200 µg/m^3 over 6 hours, and the effect level in sensitive humans associated with the ATSDR Acute MRL is 290 µg/m^3 over 14 days.

(b) California Acute REL
The California Acute REL is an acute criterion, because an exposure of 6 hours is considered an acute exposure by trained toxicologists. A single 15-minute period in excess of 76,800 µg/m^3 in the community would cause the 6 hour average concentration to exceed the criterion of 3,200 µg/m^3. Similarly, two 15-minute readings in excess of 38,400 µg/m^3 in the community would cause the 6 hour average concentration to exceed the criterion of 3,200 µg/m^3. Likewise, 24 15-minute readings in excess of 3,200 µg/m^3 in the community would cause the 6-hour average concentration to exceed the criterion of 3,200 µg/m^3. The criterion can be derived as a budget value that is the sum of 15-minute concentrations in the community.

Budget Approach

The budget approach is defined by the sum of twenty four 15-minute community concentrations as follows:

$$24 \text{ periods} \times 3{,}200\ \mu g/m^3 = 76{,}800\ \mu g/m^3\text{-periods}$$

This approach provides maximum flexibility and takes into account all possible scenarios of community concentrations over the course of a six hour period. When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15 minute readings. Because downwind measurements are taken two times very hour, the workday allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is 76,800 µg/m^3 / 2 = 38,400 µg/m^3. If the total of any number of 15-minute readings within a 6 hour period exceeded the fence line budget, the Stop Work order would need to be announced.

The budget approach is defined by the sum of twelve 15-minute community concentrations when samples are collected twice per hour as follows:

12 periods x 3,200 µg/m^3 = 38,400 µg/m^3-periods

(c) ATSDR Acute MRL

The ATSDR Acute MRL is not really an acute criterion as the term is used by trained toxicologists, because it is defined to be applicable to an exposure period of 14 days. A 14-day exposure is defined as a "subacute" exposure by toxicology experts and toxicology laboratories. To derive a fence line Stop Work criterion for a 24-hour period based on a community toxicological criterion that must be averaged over 14 days requires special consideration. Assuming that the air quality on the other 13 days during the 14-day period is at background (0.6 µg/m^3), the effect level in sensitive humans for the 24-hour period of interest is 3,980 µg/m^3 because this single day's value averaged with 13 days at local background concentrations equals 290 µg/m^3 which is the effect level in sensitive humans associated with the ATSDR 14-Day MRL. Of course, in the unlikely event that the site experienced 14 days of heavy emissions in a row, then the fence line criterion would not have been protective enough. Because it is virtually impossible to hypothesize that site managers would allow high level emissions to be released from the site day after day for 14 days in a row, a protective but practical fence line criterion should be derived using a 24-hour target concentration in the community somewhere between 290 µg/m^3 and 3,980 µg/m^3. It is proposed here that the mid-point between these two boundary conditions be established as the appropriate effect level in sensitive humans over one 24-hour period based on the ATSDR 14-Day MRL. The midpoint is 2,135 µg/m^3. The total budget for 24 hour, 15-minute periods is calculated as

Community Budget	24 x 4 x 2,135 µg/m^3 = 204,960 µg/m^3-periods

To derive a community-based criterion for a 24-hour exposure period, one must take into account the fact the work will only occur for 8, 10 or 12 hours a day. This means that 32, 40, or 48 15-minute periods during the day are subject to site emissions due to work activities. The remaining 64, 56, or 48 15-minute time periods are assumed to be associated with background levels of benzene, which was cited as 0.6 µg/m^3 in the 2005 EIS (AMEC, 2005). Accordingly, a small fraction of the 24-hour budget of 204,960 µg/m^3-periods is consumed by ambient background levels in Sydney. The amount of the budget remaining for allocation to the work day is derived as follows for the 10-hour workday case:

Community Budget	204,960 µg/m^3-periods
(-) Background	56 x 0.6 µg/m^3 = 33.6 µg/m^3-periods
Workday Allocation	204,960 µg/m^3 - 33.6 µg/m^3 = 204,926 µg/m^3-periods

Workday allocations for 8-hour and 12-hour days are 204,922 µg/m^3 and 204,931 µg/m^3 respectively.

Budget Approach

The budget approach is defined by the workday allocations as noted above. This approach provides maximum flexibility and takes into account all possible scenarios of

community concentrations over the course of a ten-hour period. When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15-minute readings. Because downwind measurements are taken two times every hour, the workday allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is simply one-half of those calculated above assuming four 15-minute periods per hour. This ensures that each 15-measurement receives double weighting to ensure that the workday average is correctly calculated. If the total of any number of 15-minute readings assuming that two 15-measurements are taken every hour exceeded the fence line budget, the Stop Work order would need to be announced.

Workday Allocation Budgets

8-Hour Workday	102,461 µg/m^3
10-Hour Workday	102,463 µg/m^3
12-Hour Workday	102,466 µg/m^3

(d) Summary of Acute Criteria
Community toxicological criteria that are protective against acute toxic effects in members of the community were derived from numerous governmental criteria, including AEGLs, ERPGs, the California Acute REL and the ATSDR Acute MRL. The most protective of all of the criteria discussed above are the criteria based on the California Acute REL and the Lowest Observed Adverse Effect Level (LOAEL) in sensitive humans from the ATSDR Acute MRL for a 14-day exposure applied to a single day of exposure.

The acute toxicity-based criteria that could be used as fence line real-time “Stop Work” criteria are as follows. These community criteria assume that there are two 15-minute measurements per hour:

Six-Hour Budget of 38,400 µg/m^3 in the community summed over 12 15-minute measurement periods

Eight-Hour Budget of 102,461 µg/m^3 in the community summed over 16 15-minute measurement periods

Ten-Hour Budget of 102,463 µg/m^3 in the community summed over 20 15-minute measurement periods

Twelve-Hour Budget of 102,466 µg/m^3 in the community summed over 24 15-minute measurement periods

The above criteria are designed to ensure the sensitive members of the population do not experience actual acute toxicological effects, such as those observed in the toxicological studies from which ATSDR and California EPA derived their respective health-based benchmarks. However, the above community risk-based criteria have only one margin of safety included in their derivation, the safety factor of 10 to ensure that especially sensitive humans are protected in addition to average members of the

population. They are provided here because regulators have specifically requested to see what concentrations of benzene in the community during clean up work activities would actually be a cause for concern that residents might actually experience adverse health outcomes from a short-time exposure to emissions that could in theory migrate from the site to the nearby residential communities.

These criteria are shown here to provide this perspective, but they are not proposed as the basis of the fence line stop work criteria. Instead these stop work criteria will be derived by invoking additional margins of safety as noted in the next section.

C. Derivation of Toxicological Criteria Based on *No Effect Levels* Associated With Acute Toxicological Effects for Use in Deriving Real-Time Fence Line Stop Work Criteria For Benzene

Federal health agencies derive and present regulatory criteria that are protective of human health with the addition of an additional safety factor so that the criteria are based on No Observed Adverse Effect Levels, not Lowest Observed Adverse Effect Levels. The criteria below are derived with the inclusion of this additional safety factor, but AMEC wishes to note that exceedance of such a criterion does not indicate that any adverse effects in the exposed population are expected. Instead, such an exceedance only indicates that an arbitrary level set to be overly protective was exceeded.

TABLE 2
SUMMARY OF NO ADVERSE EFFECT LEVELS FOR ACUTE EXPOSURES IN HUMANS FOR BENZENE

Criterion	Exposure / Averaging Time	Source
13,000 µg/m^3	6 hours	Acute California REL (No effect level in average people)
1,300 µg/m^3	6 hours	Acute California REL (No effect level in *sensitive* people)
290 µg/m^3	14 days	Acute ATSDR MRL (No effect level in average people)
29 µg/m^3	14 days	Acute ATSDR MRL (No effect level in *sensitive* people)
214 µg/m^3	1 day	Derived from Acute ATSDR MRL (No effect level in *sensitive* people)*

* See text

(a) California Acute REL – No Adverse Effect Level

The California Acute REL is an acute criterion, because an exposure of 6 hours would be considered an acute exposure by trained toxicologists. A single 15-minute period in excess of 31,200 µg/m^3 in the community would cause the 6 hour average concentration to exceed the no effect criterion of 1,300 µg/m^3. Similarly, two 15-minute readings in excess of 15,600 µg/m^3 in the community would cause the 6 hour average concentration to exceed the no effect criterion of 1,300 µg/m^3. Likewise, 24 15-minute readings in excess of 1,300 µg/m^3 in the community would cause the 6-hour average concentration

to exceed the criterion of 1,300 µg/m^3. The criterion can be derived as a budget value that is the sum of 15-minute concentrations in the community.

Budget Approach

The budget approach is defined by the sum of twenty four 15-minute community concentrations as follows:

24 periods x 1,300 µg/m^3 = 31,200 µg/m^3-periods

This approach provides maximum flexibility and takes into account all possible scenarios of community concentrations over the course of a six hour period. When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15 minute readings. Because downwind measurements are taken two times very hour, the workday allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is 31,200 µg/m^3 / 2 = 15,600 µg/m^3. If the total of any number of 15-minute readings within a 6 hour period exceeded the fence line budget, the Stop Work order would need to be announced.

The budget approach is defined by the sum of twelve 15-minute community concentrations when samples are collected twice per hour as follows:

12 periods x 1,300 µg/m^3 = 15,600 µg/m^3-periods

(b) ATSDR Acute MRL - No Adverse Effect Level
The ATSDR Acute MRL is not really an acute criterion as the term is used by trained toxicologists, because it is defined to be applicable to an exposure period of 14 days. A 14-day exposure is defined as a “subacute” exposure by toxicology experts and toxicology laboratories. To derive a fence line Stop Work criterion for a 24-hour period based on a community toxicological criterion that must be averaged over 14 days requires special consideration. Assuming that the air quality on the other 13 days during the 14-day period is at background (0.6 µg/m^3), the effect level in sensitive humans for the 24-hour period of interest is 398 µg/m^3 because this single day’s value averaged with 13 days at local background concentrations equals 29 µg/m^3 which is the no adverse effect level in sensitive humans derived from the ATSDR 14-Day MRL. Note that the No Observed Adverse Effect Level is a calculated level that assumes that no effects would be observed in sensitive humans until the concentration dropped to ten times less than the concentration estimated to cause effect.

Of course, in the unlikely event that the site experienced 14 days of heavy emissions in a row, then the fence line criterion would not have been protective enough. Because it is virtually impossible to hypothesize that site managers would allow high level emissions to be released from the site day after day for 14 days in a row, a protective but practical fence line criterion should be derived using a 24-hour target concentration in the community somewhere between 29 µg/m^3 and 398 µg/m^3. It is proposed here that the mid-point between these two boundary conditions be established as the appropriate effect level in sensitive humans over one 24-hour period based on the ATSDR 14-Day

MRL. The midpoint is 214 µg/m^3. The total budget for 24 hour, 15-minute periods is calculated as

Community Budget 24 x 4 x 214 µg/m^3 = 20,544 µg/m^3

To derive a community-based criterion for a 24-hour exposure period, one must take into account the fact the work will only occur for 8, 10 or 12 hours a day. This means that 32, 40, or 48 15-minute periods during the day are subject to site emissions due to work activities. The remaining 64, 56, or 48 15-minute time periods are assumed to be associated with background levels of benzene, which was cited as 0.6 µg/m^3 in the 2005 EIS (AMEC, 2005). Accordingly, a small fraction of the 24-hour budget of 20,544 µg/m^3-periods is consumed by ambient background levels in Sydney. The amount of the budget remaining for allocation to the work day is derived as follows for the 10-hour workday case:

Community Budget	20,544 µg/m^3-periods
(-) Background	56 x 0.6 µg/m^3 = 33.6 µg/m^3-periods
Workday Allocation	20,544 µg/m^3 - 33.6 µg/m^3 = 20,510 µg/m^3-periods

Workday allocations for 8-hour and 12-hour days are 20,506 µg/m^3 and 20,515 µg/m^3 respectively.

Budget Approach

The budget approach is defined by the workday allocations as noted above. This approach provides maximum flexibility and takes into account all possible scenarios of community concentrations over the course of a 8-, 10-, or 12-hour period. When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15-minute readings. Because downwind measurements are taken two times every hour, the workday allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is simply one-half of those calculated above assuming four 15-minute periods per hour. This ensures that each 15-measurement receives double weighting to ensure that the workday average is correctly calculated. If the total of any number of 15-minute readings assuming that two 15-measurements are taken every hour exceeded the fence line budget, the Stop Work order would need to be announced.

TABLE 3
WORK DAY ALLOCATION BUDGETS

Work Day	Work Day Allocation Budget[1]	Work Day Equivalent Concentration[2]
8-Hour Workday	10,253 µg/m^3	641 µg/m^3
10-Hour Workday	10,255 µg/m^3	513 µg/m^3
12-Hour Workday	10,258 µg/m^3	427 µg/m^3

[1] Allowable community concentration over the work day used to derive real time fence line stop work criterion. Budget applied to the sum of 15-minute readings taken two times per hour.
[2] Allowable community concentration over the work day shown here for illustrative purposes only.

(c) Summary of Acute Criteria – No Adverse Effect Levels
Community toxicological criteria that are protective against acute toxic effects in members of the community were derived from the No Observed Adverse Effect Levels from the California Acute REL and the ATSDR Acute MRL. The most protective of these criteria discussed above are the criteria based on the No Observed Adverse Effect Level (NOAEL) in sensitive humans from the ATSDR Acute MRL for a 14-day exposure applied to a single day of exposure. AMEC notes here that the ATSDR 14-Day Acute MRL cannot be used to derive health-protective fence line stop work criteria without proper consideration of the Agency's designated appropriate averaging time.

The acute toxicity-based criteria that could be used as fence line real-time "Stop Work" criteria are as follows. These community criteria assume that there are two 15-minute measurements per hour:

Six-Hour Budget of 15,600 $\mu g/m^3$ in the community summed over 12 15-minute measurement periods

Eight-Hour Budget of 10,253 $\mu g/m^3$ in the community summed over 16 15-minute measurement periods

Ten-Hour Budget of 10,255 $\mu g/m^3$ in the community summed over 20 15-minute measurement periods

Twelve-Hour Budget of 10,258 $\mu g/m^3$ in the community summed over 24 15-minute measurement periods

The above criteria are designed to ensure the sensitive members of the population do not exceed the No Observed Adverse Effect levels associated with the ATSDR and California EPA toxicological benchmarks. They are more protective by ten-fold if the goal were to protect people from experiencing actual acute toxicological effects.

Because the 24-hour community criteria based on the No Observed Adverse Effect levels associated with the ATSDR 14-Day Acute MRL are lower and hence more protective than the criterion derived from the California Acute REL, these values are proposed here as the community-based 24-hour risk-based criteria for use in deriving real time fence-line stop work criteria.

Proposed Work Day Allocation Budgets for Benzene

Eight-Hour Budget of 10,253 $\mu g/m^3$ in the community summed over 16 15-minute measurement periods

Ten-Hour Budget of 10,255 $\mu g/m^3$ in the community summed over 20 15-minute measurement periods

Twelve-Hour Budget of 10,258 μg/m^3 in the community summed over 24 15-minute measurement periods

D. Derivation of Dilution/Dispersion Factors Between Fence Line and Community Receptors

A conservative screening level air dispersion analysis was performed using the SCREEN3 dispersion model to determine dilution/dispersion factors considering all fence line locations and community receptor locations around the Tar Ponds for three time periods, 15 minutes to 8, 10 or 12 hours. As noted below, one conservative factor is used for all three potential work day lengths. The factor is:

- 3.33 for 15' to 8-12 hours

SCREEN3 requires two distance measurements to execute the model, the distance from the source to the fence line where the measurement will be taken and the distance from the fence line where the measurement will be taken to the community receptor location. In this case, work areas in the Tar Ponds can occur anywhere in both the North and South Ponds. The fence line monitoring locations were taken from Attachment 1 of AECOM's (2008) "Remediation of the Tar Ponds and Coke Ovens Sites, Design and Construction Oversight Services." Receptor locations include all residential buildings and planned community monitoring stations. For this analysis, the nearest receptor locations were identified as a conservative measure.

Dilution from the fence lines where the monitoring device will be located to the nearest receptor locations is greatest when the source of the emissions is near the fence line and least when the source of the emissions is distant from the fence line. The latter gives the most conservative (health protective) dispersion factors. Accordingly, the maximum distances in each of the 16 nominal wind directions (W, WSW, SW, SSW, S, SSE, SE, ESE, E, ENE, NE, NNE, N, NNW, NW, WNW) from potential sources to fence lines and minimum distances from fence lines to receptor locations were determined from georeferenced Site maps using GIS software (AMEC, 2005). Figure 1 shows the locations and distances. These distances are summarized on Table 4 and weighted by the relative frequency that the wind blows from a certain direction.

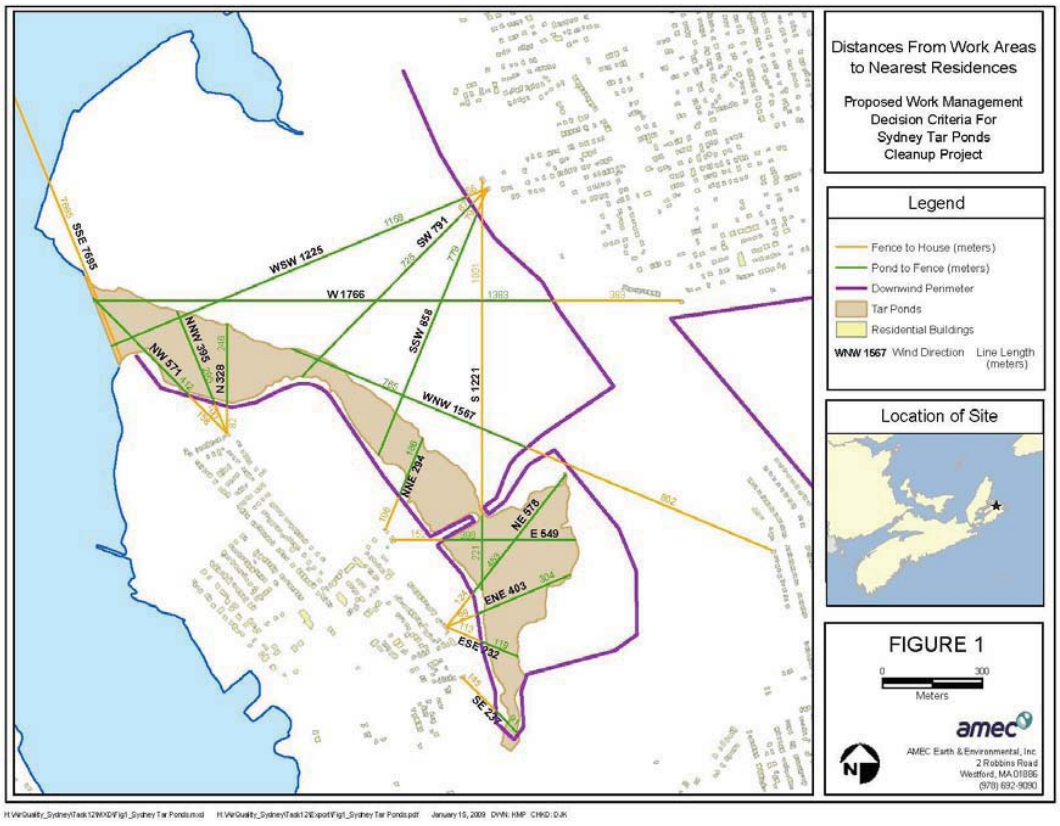
Distances From Work Areas to Nearest Residences
Proposed Work Management Decision Criteria For Sydney Tar Ponds Cleanup Project
Legend
Fence to House (meters)
Pond to Fence (meters)
Downwind Perimeter
Tar Ponds
Residential Buildings
WNW 1567 Wind Direction Line Length (meters)
Location of Site
FIGURE 1
0 300
Meters
amec
AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090
SSE 1695
WSW 1225
SW 791
W 1766
SSW 858
S 1221
WNW 1567
NW 571
NNW 395
N 828
NNE 284
NE 576
E 549
ENE 403
ESE 732
SE 235

TABLE 4
CALCULATION OF WIND DIRECTION WEIGHTED DISTANCES
FOR DISPERSION FACTOR ESTIMATION

Direction	Multiplier*	Length (m)	Work Area to Fence Line Length (m)	Fence Line to House Length (m)	Weighted Work Area to Fence Line (m)	Weighted Fence Line to House (m)
E	0.02	549.42	397.70	151.72	7.95	3.03
ENE	0.02	403.11	303.65	99.46	6.07	1.99
ESE	0.02	231.72	119.12	112.59	2.38	2.25
N	0.06	327.56	245.58	81.98	14.74	4.92
NE	0.04	577.81	453.33	124.47	18.13	4.98
NNE	0.05	293.89	186.03	107.86	9.30	5.39
NNW	0.05	394.59	294.81	99.78	14.74	4.99
NW	0.05	570.72	412.48	158.24	20.62	7.91
S	0.06	1,221.43	220.51	1,000.92	13.23	60.06
SE	0.03	236.77	91.42	145.34	2.74	4.36
SSE	0.04	7,694.77	0.00*	0.00*	0.00	0.00
SSW	0.09	857.74	778.97	78.77	70.11	7.09
SW	0.15	791.20	724.59	66.62	108.69	9.99
W	0.09	1,766.20	1,382.98	383.22	124.47	34.49
WNW	0.06	1,566.72	765.19	801.52	45.91	48.09
WSW	0.12	1,225.08	1,158.61	66.48	139.03	7.98
Direction Weighted Distance					598.13	207.52

* When the wind is from the SSE, there are no potential receptors.

Direction weighted work area-to-fence line and fence line-to-house distances were input to SCREEN3. To estimate the dispersion factors for this source-receptor arrangement, SCREEN3 was programmed to evaluate the dispersion of a ground-level area emission source equivalent to 21 m x 90 m, which is approximately the size of the daily stabilization area defined in AECOM (2008). SCREEN3 was also programmed to evaluate the full range of meteorological conditions. Output from SCREEN3 for the direction-weighted distances were converted from 1-hour average concentrations to 15-minute concentrations using the technique described in Turner (1970) for converting 1-hour average concentrations to averaging times less than 1-hour. Turner recommends that concentrations for averaging times greater than 1-hour be scaled by a time-averaging factor equal to the ratio of 1-hour over the shorter time frame raised to the 0.2 power. For this evaluation, a 15-minute average is computed using the following equation:

$(60 \text{ min}/15 \text{ min})^{0.2}$ x 1-hour average concentration = 15 minute average concentration

The 15-minute to 8-hour, 10-hour and 12-hour conversion factor requires that the 1-hour SCREEN3 concentrations be converted to concentrations over longer time periods. To accomplish this, the 1-hour average concentration from SCREEN3 was multiplied by 0.7, which is the 1-hour to 8-hour conversion factor recommended by EPA. The 8-hour

average concentration was conservatively assumed to representative of the 10-hour concentration and the 12-hour concentration. The use of the EPA one-hour to 8-hour conversion factor in deriving criteria for 10-hour and 12-hour work days provides an additional margin of safety to the derivation of the real time fence line stop work criteria. The 15-minute to 8-, 10-, and 12-hour conversion factor is then computed by dividing the 15-minute concentration at the fence line by the 8-, 10-, and 12-hour concentration at the receptor location.

It is important to note that the SCREEN3 model conservatively defaulted to meteorological data that are indicative of the most stable conditions (stability class 6 and a wind speed of 1.0 m/s). These conditions only occur during the night-time hours. Daytime atmospheric conditions result in a more turbulent atmosphere resulting in greater dispersion. Nevertheless, the default SCREEN3 output was used for this assessment as a means to provide a conservative bounding estimate to the dispersion factors.

E. Derivation of Fence Line Stop Work Criteria For Benzene

To derive the fence line Stop Work criteria, one needs to take into account the expected dilution and dispersion between the fence line and the community receptor locations and the sensitivity of the PID meters to benzene.

As noted above, the conservative dilution/dispersion factor for a 8-, 10- or 12 hour work day period is 3.33. The conversion factor from $\mu g/m^3$ to ppm for benzene at 20 degrees Celsius is 3,193 $\mu g/m^3$ per ppm. The PID sensitivity for benzene is 0.6. The fence line Stop Work criteria are derived as follows:

> Eight-Hour Budget of 10,253 $\mu g/m^3$ in the community summed over 16 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/3,193) x (1/0.6) = 18 ppm summed over 16 15-minute measurement periods (8-Hour Workday)
>
> Ten-Hour Budget of 10,255 $\mu g/m^3$ in the community summed over 20 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/3,193) x (1/0.6) = 18 ppm summed over 16 15-minute measurement periods (10-Hour Workday)
>
> Twelve-Hour Budget of 10,258 $\mu g/m^3$ in the community summed over 24 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/3,193) x (1/0.6) = 18 ppm summed over 16 15-minute measurement periods (12-Hour Workday)

F. Implementation of Fence Line Stop Work Criteria For Benzene

The budget approach can be simply employed by having the monitoring team take 15-minute fence line PID readings and add them on a simple hand-held calculator, or an Excel spreadsheet programmed on a field computer or hand-held PDA, or by manually adding the values as they are entered into a field notebook. Work can continue as long as the total for the day does not exceed 18 ppm. However, one can never predict what the next reading will be, so practically speaking, on cannot employ the budget as is in

the field. One needs to “hold back” some of the budget as insurance that the next reading will not take the total over the day to a value that *exceeds* the budget.

Accordingly, it is proposed that the Stop Work criterion be set at 1/3 the allowable daily budget for the work day. In essence, this approach assumes that the last reading before stopping work could be as high as 1/3 the budget regardless of the monitoring history for the day. Thus, implementation of the daily work day budget of 18 ppm requires that work be stopped when the running total meets or exceeds 12 ppm.

Note that site personnel can easily make predictions throughout the day as to what the sum might be later in the day to provide even greater margins of safety to the community. If site personnel make a simple calculation and assume that the readings at the end of the day might be as high as the highest reading seen already on that day and the *predicted* sum exceeds 12 ppm, then site activities can be modified or work can be stopped prematurely so that no exceedance occurs.

Table 5 below shows four scenarios of measurements that could be envisioned for a clean up work day. Case 1 shows a case where stopping work when the total budget for the day reaches 12 ppm. In this case, the budget was only half expended, but work is stopped because the next measurement could be higher than measurements seen earlier in the day and take the total budget above the daily target of 18 ppm. Cases 2 and 3 are examples of cases where the final reading takes the running total above 12 ppm. However, by providing the “hold back,” the total day’s budget did not exceed the daily budget of 18 ppm.

Case 4 is an example of a case where work would be stopped when the running total exceeded 12 ppm, but the actual daily budget exceeded the health-based target of 18 ppm. While it is possible to create hypothetical scenarios such as this, experience with the various cleanup activities that have taken place to date indicate that it is extremely unlikely that fence line PID measurements approaching 10 ppm would ever been seen during the project activities. As noted above, in actual practice site personnel will be making predictions all day long about what the sum might be later in the day. Thus, a case such as Case 4 is unlikely to actually happen in real practice. Specifically, when site personnel saw the readings rise from 2 ppm to 6 ppm with a subtotal of 10.2 ppm, they would clearly be on alert that if the next reading were a 6 ppm, the subtotal would rise to 16.2, which would exceed the criterion of 12 ppm. In fact, the only way the criterion of 12 ppm would not be exceeded would be if the next reading were less than 1.8 ppm. With a trend over the last two hours having been shown to be 0.4 ppm to 1 ppm to 2 ppm to 6 ppm, site personnel would almost certainly assume that the next reading would not be as low as 1.8 ppm. They would take action in such a circumstance before obtaining the next reading.

In addition, even is such a scenario did occur, it would not actually compromise human health of people living in the nearby communities because of the multiple layers of safety that are incorporated into the derivation of this real time fence line stop work criterion. Hence, the budget approach is a sound approach for protecting members of the community.

TABLE 5
EXAMPLES OF USE OF THE BUDGET APPROACH FOR BENZENE (ppm)
ASSUMING 12-HOUR WORKDAY

15' PERIOD	CASE 1	CASE 1 Totals	CASE 2	Case 2 Totals	CASE 3	CASE 3 Totals	CASE 4	CASE 4 Totals
1	1	1	.1	.1	.1	.1	.1	.1
2	1	2	.1	.2	.1	.2	.1	.2
3	1	3	.1	.3	.1	.3	.1	.3
4	1	4	.1	.4	.1	.4	.1	.4
5	1	5	.1	.5	.1	.5	.1	.5
6	1	6	.1	.6	.1	.6	.1	.6
7	1	7	.1	.7	.1	.7	.2	.8
8	1	8	.1	.8	.1	.8	.4	1.2
9	1	9	5	5.8	1	1.8	1	2.2
10	1	10	7	12.8	2	3.8	2	4.2
11	1	11		Stop[1]	3	6.8	6	10.2
12	1.5	12.5			4	10.8	12	22.2
13		Stop[1]			5	15.8		Stop[2]
14						Stop[1]		
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

[1]Stop Work would be ordered at this point in time even though the actual fence line work day target budget of 18 ppm was not actually exceeded. This is because of the additional margin of safety added in this document and called a "hold back" provision. The "hold back" is used to take into account the uncertainty caused by the day's "next reading." If the next reading were always similar to the last reading or the average readings over the day, then the "hold back' provision would not be necessary. However, because there is always a possibility that the next reading could be different and considerably higher than the previous readings on any given day, the "hold back" provision can ensure that the actual health-based target concentrations in the community are not exceeded.

[2] Stop Work would be ordered and this time because the last reading was greater than 12 ppm. In this case the health-based goal of 18 ppm would have been exceeded, but as noted in the text, such a scenario is unlikely to occur in practice. In addition, the health-based criterion of 18 ppm is not associated with actual health effects and would not compromise human health.

G. Summary of Implementation of Fence Line Stop Work Criterion

Members of the residential communities in the vicinity of the Tar Ponds and Coke Ovens Sites can be protected against adverse health effects due to benzene exposure if fence line monitoring results are compared to the following Stop Work criterion regardless of the length of the work day.

- Stop Work if the daily running total of 15-minute measurement periods (2 per hour) exceeds 12 ppm at any point during the day to ensure that a daily fence line budget does not exceed 18 ppm

The approach is a flexible approach for monitoring work activities. The running budget approach explicitly takes into account the previous readings on any given day and also takes into account the uncertainty about the next reading that could follow on any given day by using a "hold back" provision. The use of the 12 ppm real time stop work criterion ensures that the total cumulative reading at the fence line on any given day does not exceed the work day budget of 18 ppm.

H. Protectiveness of the Fence Line Stop Work Criterion

The real time fence line stop work criterion for benzene is derived with multiple layers of safety factors. This section briefly summarizes the assumptions and factors used to demonstrate that the criterion is more than adequately protective of human health.

1. No Observed Adverse Effect Level used as the basis of the criterion, which is ten-fold more protective than the Lowest Observed Adverse Effect level for sensitive members of the community.
2. Dispersion factor derived using SCREEN3 screening level air dispersion model, which is a conservative screening level model that is recognized by all as providing conservative results.
3. The SCREEN3 model conservatively defaulted to meteorological data that are indicative of the most stable conditions (stability class 6 and a wind speed of 1.0 m/s). These conditions only occur during the night-time hours. Daytime atmospheric conditions result in a more turbulent atmosphere resulting in greater dispersion.
4. SCREEN3 was executed assuming that benzene was being released from the site as a constant source all day long, whereas any emissions that might occur would be intermittent at worst.
5. The use of the EPA one-hour to 8-hour conversion factor in deriving criteria for 10-hour and 12-hour work days provides an additional margin of safety to the derivation of the real time fence line stop work criteria for 10-hour and 12-hour work day scenarios.
6. An additional margin of safety called the "hold back," which was 1/3 of the health-based goal was added to take into account the uncertainty about the last measurement during any monitoring period. This added yet again another safety factor.

As shown above, the real time fence line stop work criterion was derived using quite a few safety factors which AMEC estimates provides a total margin of safety of 100-1000 between the health-based goal and the concentration in the community that would actually cause adverse acute effects in members of the community.

I. Health-Based Regulatory Criteria for Community Monitors

Health-based criteria are available from governmental regulatory agencies to protect members of the community from both acute and chronic health effects. For acute effects, as noted in the previous section, in the *most sensitive* humans, no acute effects would be expected of any type unless community exposure levels were in the range of 415,000 µg/m^3 for 10 minutes, 233,000 µg/m^3 for 30 minutes, 160,000 µg/m^3 for 60 minutes, 3,200 µg/m^3 for six hours, or 290 µg/m^3 for 14 days. As an additional safety measure, the fence line Stop Work criterion previously discussed was derived from the No Observed Adverse Effect Level from the ATSDR 14-Day Acute MRL (or 29 µg/m^3), which provides an additional margin of safety of 10-fold. It has been demonstrated in this document that the proposed fence line Stop Work criteria are adequately protective to ensure that the ATSDR 14-Day Acute regulatory criterion is not exceeded in community monitoring samples if the real time fence line stop work criteria are implemented.

To assess chronic health effects, it is assumed that community monitoring will continue to be accomplished via the use of 24-hour sampling of community air. For compliance purposes, there are four available long term (chronic) toxicological criteria for benzene: (1) ATSDR Chronic Minimum Risk Level (MRL), (2) California Chronic Reference Exposure Level (REL), (3) U.S. EPA Chronic Reference Concentration (RfC) and (4) Health Canada Tumour Concentrations (5%). One or more of these criteria can be used as a regulatory compliance criterion.

As noted above, the ATSDR Chronic MRL is 10 µg/m^3. The California chronic REL is 60 µg/m^3, but this is based on a No Observed Adverse Effect Level, so the level associated with toxicological effects in the most sensitive humans is >60 µg/m^3. The EPA chronic Reference Concentration is 30 µg/m^3, but the level associated with toxicological effects in the most sensitive humans is 820 µg/m^3. Lastly, according to Health Canada, the risk-specific benzene concentration associated with a 1/100,000 incremental lifetime cancer risk is 24 µg/m^3 for a ten year exposure.

As shown in Table 6,the most health-protective of these criteria including regulatory safety factors is the ATSDR Chronic MRL, 10 µg/m^3. Accordingly, it is proposed to be adopted as a regulatory criterion for the project's air quality monitoring programme.

TABLE 6
CHRONIC TOXICOLOGICAL CRITERIA
BENZENE

Chronic Toxicological Criterion	Value
ATSDR Chronic MRL	10 µg/m^3 (lifetime)
California Chronic REL	60 µg/m^3 (lifetime)
U.S. EPA Chronic RfC	30 µg/m^3 (lifetime)
Health Canada Risk-Specific Concentration at 1/100,000 Risk (5 yr)	48 µg/m^3 (five years)

The 10 µg/m^3 criterion is applicable to lifetime exposure. In this case, the project activities are estimated for a period of five or more years, so the period of interest is five years. However, it is common in the practice of risk assessment to average such values

only over a single year despite the fact that there are acceptable levels for a lifetime exposure. Thus, the project goal for benzene is an *annual* average concentration of 10 $\mu g/m^3$.

It is important to note that the 10 $\mu g/m^3$ Chronic MRL is *not* a value that must be met for every 24-hour canister. Instead, the project goal is to ensure that the one-year average concentration is less than 10 $\mu g/m^3$. Many 24-hour canister samples can be higher than 10 $\mu g/m^3$ as long as ample canisters are less than 10 $\mu g/m^3$. AMEC notes that the monitoring schedule for the residential areas is one sample every sixth day. This means that there are five intervening days with no sample results. There are several ways to evaluate this censored dataset. One can assume that all five intervening days are similar to the higher of the two days with data. One can assume that all five intervening days are similar to the lower of the two days with data. When one of the two sampling days is a work day and one is not a work day, one can assume that all five intervening days are similar to the work day. One can assume that all five intervening days are similar to the average of the two days with data.

There are other approaches that could also be considered. However, *a priori*, there is no reason to expect that the work days that are monitored are systematically any different than the work days that are not monitored with community canisters. Accordingly, it is recommended that the annual average concentration be calculated by simply assuming that the running average of the monitored days is a reasonable estimate of the running average over the entire period, including the non-monitored days. On the other hand, it is a simple matter to calculate a running average using any one of several ways to estimate the concentrations at residential locations during non-monitored days.

J. Verification of Protectiveness of Stop Work Criteria Regarding Regulatory Toxicology Criteria

The fence line Stop Work criteria are designed to ensure that the 14-day concentration in the community does not exceed 29 $\mu g/m^3$, which protects the community against acute toxic effects over a short time period with an added margin of safety of 10 by using the No Observed Adverse Effect Level instead of the Lowest Observed Adverse Effect Level. To ensure that the 14-day concentration in the community does not exceed 29 $\mu g/m^3$, the concentration during the 8-, 10-, or 12-hour work day cannot exceed 641, 513, or 427 $\mu g/m^3$, respectively. It should be noted, however, that the fence line Stop Work criterion is designed with an extra margin of safety (the “hold back” provision) to ensure that work is stopped before the acute toxicological criterion of 29 $\mu g/m^3$ in the community over a 14-day period is actually reached.

Specifically, because of the “hold back” factor used to derive the fence line Stop Work criterion of 12 ppm, work will be stopped when the concentration in the community over a 10-hour work day is actually no greater than 427, 344, or 285 $\mu g/m^3$ respectively (see Section E for discussion of the “hold back” factor.) At these work-day concentrations, the 14-day concentration in the community would be less than 29 $\mu g/m^3$. This is an additional protective factor that has been added because of uncertainty in the final measurement of the day before a Stop Work order might be given.

Before the fence line Stop Work criteria are adopted, it is important to verify that regulatory criteria, which incorporate all regulatory margins of safety, are satisfied if the Stop Work criteria are adopted. The most health protective of these regulatory criteria include the following:

- Acute ATSDR MRL
  29 µg/m^3 over 14 days
- Chronic ATSDR MRL
  10 µg/m^3 over >365 days

The chronic ATSDR MRL is applicable for periods ranging from 365 days to a 70+ year lifetime. However, it is common risk assessment practice to average exposures over a period of no longer than one year when applying chronic health-based regulatory criteria. In this document, the chronic MRL will be assumed to be applicable 365 days and not 80 years, which is the Health Canada default risk assessment assumption for the lifetime of a Canadian citizen. Applying this chronic toxicological criterion to a one year time frame provides an additional margin of safety that ranges from 8 for 10-year exposure periods to 80 for one year exposure periods.

Acute ATSDR MRL (29 µg/m^3 over 14 days)

The following example is given for the 10-hour work day scenario. Similar calculations can be shown for 8-hour or 12-hour work days.

Over a 14-day period, the target running total benzene concentration assuming a goal of 29 µg/m^3 over 14 days is 9,744 µg/m^3 - hours (29 µg/m^3 x 14 days x 24 hours/day = 9,744 µg/m^3 - hours). Over this same 14-day period, there are 12 work days and 2 non-work days (assuming a 6-day work week), 10 work hours per day, and 14 non-work hours per day. Background for non-work hours and non-work days is 0.6 µg/m^3. Accordingly, the goal for the work-day hours can be calculated as follows:

Total goal for entire period:	9,744 µg/m^3 –hr
Contribution over non-work days:	2 days x 24 hr/day x 0.6 µg/m^3 = 29 µg/m^3 -hr
Contribution over work day nights:	12 days x 14 hrs/day x 0.6 µg/m^3 = 101 µg/m^3-hr
Contribution over non work hours:	(29 µg/m^3 –hr) + (101 µg/m^3-hr) = 130 µg/m^3-hr
Remaining goal for work-day hours:	(9,744 µg/m^3 –hr) – (130 µg/m^3 –hr) = 9,614 µg/m^3 –hr

The number of 10-hour work days that can exceed the fence line Stop Work criterion at any specific location and *not* exceed the acute ATSDR MRL of 29 µg/m^3 over 14 days can be calculated as follows. As noted above, 344 µg/m^3 is the community concentration over a 10-hour work day associated with the stop work criterion.

(Exceedance Days) x (10 work hrs/day) x (344 µg/m^3) = 9,614 µg/m^3 –hrs
Exceedance Days = 9,614 µg/m^3 –hrs / {(10 work hrs/day) x (344 µg/m^3)}
Exceedance Days = 3 days

In essence, the acute ATSDR MRL of 29 µg/m^3 over 14 days will be met in the community if the fence line Stop Work criterion of 24 ppm over a 10-hour period is met or exceeded no more than three times every 14-day period *at a specific location.* This

point must be re-iterated. If during a 14-day period, there are one to two exceedances at a specific fence line monitoring location on the south side of the North Tar Pond (location A) and one to two exceedances at a specific fence line monitoring location on the north side of the South Tar Pond (location B), this would not cause an exceedance of the Acute ATSDR MRL, because exceedance of this regulatory criterion is location-dependent.

The probability that an exceedance will occur every three days per 14-day period *at a specific location* cannot be predicted with accuracy. However, it is clearly very unlikely that this would ever occur. The probability of an exceedance is dependent on at least four factors: (1) Repeatedly disrupting sediments containing benzene at high concentrations in an uncontrolled manner several times within a 14-day period; (2) Repeatedly disrupting these sediments at worst case locations in terms of potential for dispersion; (3) Repeatedly disrupting these sediments during temperature and humidity conditions that promoted volatilization; and (4) Experiencing unusual meteorological conditions where the wind was consistently blowing the same direction during the entire day and *in that same direction* for 14 days in a row.

Factors #1-3 are difficult to quantify. However, factor #4 can be quantified by consulting the hour-by-hour wind data files used to perform air dispersion and deposition modeling. As shown in Tables 7-11, according to the actual Sydney wind data files, over a five year

TABLE 7
SUMMARY OF 10-HOUR WIND
DIRECTION PERSISTENCE* (1995)

Wind Direction Sector	Number of Days Wind Blows From This Direction
86.95 - 109.45	1
109.35 - 131.85	1
130.15 - 152.65	1
170.15 - 192.65	1
188.85 - 211.35	2
197.15 - 219.65	3
203.35 - 225.85	3
213.35 - 235.85	2
226.35 - 248.85	1
250.85 - 273.35	2
256.95 - 279.45	2
271.65 - 294.15	1
291.55 - 314.05	1
319.35 - 341.85	3
324.15 - 346.65	3
325.15 - 347.65	3

Notes:
*10-hour time period from 0700 to 1700.

TABLE 8
SUMMARY OF 10-HOUR WIND
DIRECTION PERSISTENCE* (1996)

Wind Direction Sector	Number of Days Wind Blows From This Direction
361.35 - 21.15	3
4.45 - 26.95	3
5.05 - 27.55	3
29.85 - 52.35	1
43.85 - 66.35	1
81.65 - 104.15	4
81.85 - 104.35	4
84.65 - 107.15	4
85.35 - 107.85	4
129.65 - 152.15	2
130.85 - 153.35	2
145.35 - 167.85	1
160.85 - 183.35	3
166.25 - 188.75	3
171.55 - 194.05	5
179.05 - 201.55	4
181.65 - 204.15	4
185.55 - 208.05	3
200.95 - 223.45	3
203.85 - 226.35	3
208.25 - 230.75	3
255.05 - 277.55	5
257.85 - 280.35	5
262.85 - 285.35	6
264.85 - 287.35	7
264.95 - 287.45	7
270.15 - 292.65	5
274.25 - 296.75	4
295.15 - 317.65	1
333.05 - 355.55	1

Notes:
*10-hour time period from 0700 to 1700.

TABLE 9
SUMMARY OF 10-HOUR WIND
DIRECTION PERSISTENCE* (1997)

Wind Direction Sector	Number of Days Wind Blows From This Direction
4.85 - 27.35	1
44.45 - 66.95	2
52.35 - 74.85	3
60.65 - 83.15	2
75.65 - 98.15	1
102.85 - 125.35	2
113.65 - 136.15	2
155.55 - 178.05	3
159.65 - 182.15	4
164.55 - 187.05	5
170.55 - 193.05	5
175.35 - 197.85	6
179.95 - 202.45	6
183.85 - 206.35	5
185.85 - 208.35	5
186.85 - 209.35	4
211.45 - 233.95	2
212.95 - 235.45	3
223.95 - 246.45	2
248.25 - 270.75	2
257.45 - 279.95	5
259.85 - 282.35	4
262.35 - 284.85	4
265.15 - 287.65	5
274.35 - 296.85	2
295.65 - 318.15	1
325.35 - 347.85	1
337.65 - 360.15	1

Notes:
*10-hour time period from 0700 to 1700.

TABLE 10
SUMMARY OF 10-HOUR WIND
DIRECTION PERSISTENCE* (1998)

Wind Direction Sector	Number of Days Wind Blows From This Direction
0.85 - 23.35	1
34.85 - 57.35	3
38.65 - 61.15	3
39.85 - 62.35	3
61.35 - 83.85	3
65.45 - 87.95	3
71.25 - 93.75	5
80.15 - 102.65	4
81.25 - 103.75	4
85.95 - 108.45	3
118.85 - 141.35	1
153.85 - 176.35	1
174.15 - 196.65	1
198.85 - 221.35	1
237.15 - 259.65	3
243.35 - 265.85	6
244.75 - 267.25	6
250.85 - 273.35	6
251.55 - 274.05	6
252.85 - 275.35	6
261.35 - 283.85	4
276.25 - 298.75	2
282.35 - 304.85	2
323.25 - 345.75	1

Notes:
*10-hour time period from 0700 to 1700.

TABLE 11
SUMMARY OF 10-HOUR WIND
DIRECTION PERSISTENCE* (1999)

Wind Direction Sector	Number of Days Wind Blows From This Direction
63.25 - 85.75	1
164.85 - 187.35	2
166.15 - 188.65	2
177.45 - 199.95	3
183.35 - 205.85	4
185.25 - 207.75	4
194.15 - 216.65	4
196.95 - 219.45	2
228.15 - 250.65	3
234.15 - 256.65	3
238.15 - 260.65	3
257.85 - 280.35	1
272.85 - 295.35	1
303.45 - 325.95	1
333.65 - 356.15	1

Notes:
*10-hour time period from 0700 to 1700.

period of meteorological data, there are only 3 to 7 instances per year in which the wind was blowing the same direction defined as a 22.5% sector over the course of a 10-hour work day (7 am to 5 pm) and 0 instances in which the wind was blowing the same direction for 14 days in a row. This simple exercise demonstrates that the use of the fence line Stop Work criteria for benzene proposed here are adequately protective of acute toxicological effects in sensitive members of the population that live in the nearby residential areas and also adheres to the Acute ATSDR MRL, a regulatory criterion derived with the full use of regulatory safety factors.

Chronic ATSDR MRL (10 µg/m^3 over 365 days)

The following example is given for the 10-hour work day scenario. Similar calculations can be shown for 8-hour or 12-hour work days.

Over a 365-day period, the target running total benzene concentration assuming a goal of 10 µg/m^3 over 365 days is 87,600 µg/m^3 -hours (10 µg/m^3 x 365 days x 24 hours/day = 87,600 µg/m^3 -hours). Over this same 365-day period, there are 235 work days and 130 non-work days (assuming a 6-day work week over a 9 month construction season), 10 work hours per day, and 14 non-work hours per day. Background for non-work hours and non-work days is 0.6 µg/m^3. Accordingly, the goal for the work-day hours can be calculated as follows:

Total goal for entire period:	87,600 µg/m^3 –hrs
Contribution over non-work days:	130 days x 24 hr/day x 0.6 µg/m^3 = 1872 µg/m^3 -hrs
Contribution over work day nights:	235 days x 14 hr/day x 0.6 µg/m^3 = 1974 µg/m^3-hrs
Contribution over non work hours:	(1872 µg/m^3–hr) + (1974 µg/m^3-hr) = 3846 µg/m^3-hr
Remaining goal for work-day hours:	(87600 µg/m^3–hr) – (3846 µg/m^3–hr) = 83754 µg/m^3–hr

The number of 10-hour work days that can exceed the fence line Stop Work criterion at any specific location and *not* exceed the chronic ATSDR MRL of 10 µg/m^3 over 365 days can be calculated as follows. As noted above, 344 µg/m^3 is the community concentration over a 10-hour work day associated with the stop work criterion.

(Exceedance Days) x (10 work hrs/day) x (344 µg/m^3) = 83,754 µg/m^3 –hrs
Exceedance Days = 83,754 µg/m^3 –hrs / {(10 work hrs/day) x (344 µg/m^3)}
Exceedance Days = 24 days

In essence, the Chronic ATSDR MRL of 10 µg/m^3 over 365 days will be met in the community if the fence line Stop Work criterion of 12 ppm over a 10-hour period is exceeded no more than 24 times every 365-day period *at a specific location.* As noted above, if during a calendar year period there are twelve exceedances at a specific fence line monitoring location on the south side of the North Tar Pond (location A) and twelve exceedances at a specific fence line monitoring location on the north side of the South Tar Pond (location B), this would not cause an exceedance of the Chronic ATSDR MRL, because exceedance of this regulatory criterion is location-dependent.

The probability that an exceedance will occur 24 times a year *at a specific location* cannot be predicted with accuracy. However, it is clearly very unlikely that this would ever occur. The probability of an exceedance is dependent on at least four factors, as

noted above. While it may be possible to envision that over a year, the workers disrupt sediments containing benzene at high concentrations in an uncontrolled manner 24 times, that they might disrupt these sediments at worst case locations in terms of potential for dispersion 24 times in the year, and they might disrupt these sediments during temperature and humidity conditions that promoted volatilization 24 times a year, it is highly unlikely that these three conditions would overlap in time very many times, if at all. More importantly, it is extremely unlikely that this constellation of conditions would occur 24 times a year when the wind is consistently blowing the same direction during the entire day and *in that same direction* for the specific 24 days on which the unusually high levels of benzene emissions occurred.

As above, the probability that unusual meteorological conditions could occur 24 times a year can be assessed by consulting five years of the hour-by-hour wind data files used to perform air dispersion and deposition modeling. As shown in Tables 7-11, according to the actual Sydney wind data files, over a five year period of meteorological data, there are only 3-7 instances per year during the five year period in which the wind was blowing the same direction defined as a 22.5% sector over the course of a 10-hour work day (7 am to 5 pm) and 0 instances in which the wind was blowing that same specific direction 24 times within a single year.

This simple exercise demonstrates that the use of the fence line Stop Work criteria for benzene proposed here are adequately protective of acute toxicological effects in sensitive members of the population that live in the nearby residential areas and also adheres to the Chronic ATSDR MRL, a regulatory criterion derived with the full use of regulatory safety factors.

K. Summary of Fence Line and Community Criteria For Benzene

The criteria for benzene are summarized below.

TABLE 12
SUMMARY OF FENCE LINE AND COMMUNITY CRITERIA FOR BENZENE

Criteria Type	**Criteria for Real-Time Fence Line Monitors (PID Meters)**
Stop Work (PID)	Running daily total of 12 ppm

Criteria Type	**Criteria for 24-hour Community Monitors (Laboratory Data)**
Regulatory Compliance	Calendar Year Annual Average: 10 µg/m^3

III. NAPHTHALENE

A. Summary of Toxicological Criteria For Naphthalene

1. Acute Toxicity

(a) U.S. EPA Acute Inhalation Exposure Criteria (2005)

75,000 µg/m^3 (One Hour)

2. Subchronic Toxicity

(a) Subchronic Criterion Derived From Ontario MOE (1987)*
Subchronic Criterion = 225 µg/m^3
NOAEL = 6.4 mg/kg/day (oral dosing)
Composite Safety Factor = 100
10 Animal to human
10 Human variability

Effect Levels
Average Human Effect Level: >6.4/10 = >0.64 mg/kg/day = >2,240 µg/m^3
Sensitive Human Effect Level: >0.64/10 = >0.064 µg/m^3 = >224 µg/m^3

No Effect Levels
Average Human No Effect Level: 6.4/10 = 0.64 mg/kg/day = 2,240 µg/m^3
Sensitive Human No Effect Level: 0.64/10 = 0.064 µg/m^3 = 224 µg/m^3

*Ontario Ministry of Environment documentation lists the NOAEL from an oral dosing study in rodents was 6.4 mg/kg/day and that the criterion was derived assuming 20 m^3/day inhalation by a 70 kg person. Assuming the standard safety factors of 10 for animal to human variability and 10 for human variability, the remaining safety factor of 10 is logically assumed to be a factor of 10 for subchronic to chronic study duration. In deriving this subchronic criterion, AMEC has employed only the two safety factors of 10 for animal to human variability and 10 for human variability, because the additional safety factor for subchronic to chronic study duration is not necessary.

3. Chronic Toxicity

(a) *Chronic ATSDR MRL (> 365 days)*
MRL = 3.67 µg/m^3
Endpoint = Respiratory effects
LOAEL = 0.2 ppm
Composite Safety Factor = 300
10 LOAEL to NOAEL
3 Animal to human
10 Human variability

Effect Levels
Average Human Effect Level: 0.2 /3 = 0.07 ppm = 367 µg/m^3

Sensitive Human Effect Level: 367/10 = 37 µg/m^3

No Effect Levels
Average Human No Effect Level: 0.2 /30 = 0.007 ppm = 37 µg/m^3
Sensitive Human Effect No Effect Level: 37/10 = 3.7 µg/m^3

(b) Chronic CA REL (lifetime)
REL = 9 µg/m^3
Endpoint = Respiratory effects
LOAEL =1.8 ppm
Composite Safety Factor = 1000
10 LOAEL to NOAEL
10 Animal to human
10 Hum variability

Effect Levels
Average Human Effect Level: 1.8/10 = 0.18 ppm = 943 µg/m^3
Sensitive Human Effect Level: 943/10 = 94 µg/m^3

No Effect Levels
Average Human Effect Level: 1.8/100 = 0.018 ppm = 94 µg/m^3
Sensitive Human Effect Level: 94/10 = 9.4 µg/m^3

(c) Chronic EPA RfC (lifetime)
RfC = 3 µg/m^3
Endpoint = Nasal effects
LOAEL = 9,300 µg/m^3
Composite Safety Factor = 3000
10 LOAEL to NOAEL
10 Animal to human
10 Human variability
3 Database deficiencies

Effect Levels
Average Human Effect Level: 9,300/10 = 930 µg/m^3
Sensitive Human Effect Level: 930/10 = 93 µg/m^3

No Effect Levels
Average Human No Effect Level: 9,300/100 = 93 µg/m^3
Sensitive Human No Effect Level: 93/10 = 9.3 µg/m^{3*}

* Note that the MRL is 9.3 µg/m^3/3 = 3 µg/m^3 because of the additional safety factor of 3 for “database deficiencies.”

B. Derivation of Toxicological Criteria Based on *Acute and Subchronic Toxicological Effect Levels* for Use in Deriving Real-Time Fence Line Stop Work Criteria For Naphthalene

AEGLs, ERPGs, and California Acute Reference Exposure Levels are not available for naphthalene. The only regulatory criterion available was the U.S. EPA (2005) Acute Inhalation Exposure Criterion. Because the EPA compares this value to the maximum one hour estimated concentration from combustor stack emissions to calculate an Acute Hazard Quotient for naphthalene when evaluating permits for combustion facilities, this value is a No Observed Adverse Effect Level and it applies to all members of the community, including sensitive individuals. Thus, no acute effects would be expected of any type in the *average* person unless exposure levels were >>75,000 µg/m^3 for one hour. In the *most sensitive* humans, no acute effects would be expected of any type unless exposure levels were >75,000 µg/m^3 for one hour.

Because the effect levels can only be estimated as "greater than" the no effect levels for this criterion, stop work criteria are not defined here based on the EPA AIEC. Instead such values would simply be greater than the value derived in Section C below.

TABLE 13
SUMMARY OF ACUTE EFFECT LEVELS IN HUMANS FOR NAPHTHALENE

Criterion	Exposure / Averaging Time	Source
>>75,000 µg/m^3	One hour	U.S. EPA AIEC (EPA, 2005) (estimated acute effect level for *average* individuals)
>75,000 µg/m^3	One hour	U.S. EPA AIEC (EPA, 2005) (estimated acute effect level for *sensitive* individuals)

Similarly, the subchronic no effect level used in Section C below is based on a study in which the No Observed Adverse Effect Level is reported. Because the subchronic effect levels can only be estimated as "greater than" the no effect levels for this criterion, stop work criteria are not defined here based on subchronic effects.

C. Derivation of Toxicological Criteria Based on *No Acute and Subchronic Toxicological Effect Levels* for Use in Deriving Real-Time Fence Line Stop Work Criteria For Naphthalene

AEGLs, ERPGs, and California Acute Reference Exposure Levels are not available for naphthalene. The only regulatory criterion available was the U.S. EPA (2005) Acute Inhalation Exposure Criterion. Because the EPA compares this value to the maximum one hour estimated concentration from combustor stack emissions to calculate an Acute Hazard Quotient for naphthalene when evaluating permits for combustion facilities, this value is a No Observed Adverse Effect Level and it applies to all members of the community, including sensitive individuals. Thus, the no acute adverse effect level in the

average person would be estimated as >75,000 µg/m^3 for one hour. In the *most sensitive* humans, the no acute adverse effect level is 75,000 µg/m^3 for one hour.

TABLE 14
SUMMARY OF ACUTE NO EFFECT LEVELS IN HUMANS FOR NAPHTHALENE

Criterion	Exposure / Averaging Time	Source
>75,000 µg/m^3	One hour	U.S. EPA AIEC (EPA, 2005) (no acute effect level for *average* individuals)
75,000 µg/m^3	One hour	U.S. EPA AIEC (EPA, 2005) (no acute effect level for *sensitive* individuals)

(a) Acute Inhalation Exposure Criterion (AIEC) (EPA, 2005)

It is thus proposed that a Stop Work criterion for the real-time monitors to ensure that no adverse effect levels for acute effects are not exceeded in the community be set using a community concentration of 75,000 µg/m^3 over a one-hour monitoring period.

No day-long budget approach can be defined for this criterion because it is based on a one-hour averaging time. However, a one-hour budget (four 15-minute periods) can be established.

The total budget for 4,15-minute periods is calculated as:

Community Budget 4 x 75,000 µg/m^3 = 300,000 µg/m^3-periods

When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15-minute readings. Because downwind measurements are taken two times every hour, the one-hour allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is simply one-half of those calculated above assuming four 15-minute periods per hour. This ensures that each 15-measurement receives double weighting to ensure that the workday average is correctly calculated. If the total of any two adjacent 15-minute readings assuming that two 15-measurements are taken every hour exceeded the fence line budget, the Stop Work order would need to be announced.

Accordingly, the Monitoring Programme Budget is 150,000 µg/m^3-periods. Thus, a health-based criterion for naphthalene to ensure that no adverse effect levels for acute effects are not exceeded in the community would be defined as follows assuming a monitoring programme with two 15-minute measurements per hour:

- One-Hour Budget of 150,000 µg/m^3 in the community summed over two temporally adjacent 15-minute measurement periods.

(b) Ontario Ministry of Environment Ambient Air Quality Criterion

A regulatory criterion for naphthalene was established as an Ambient Air Quality Criterion by the Ontario Ministry of the Environment in 1987. Limited documentation is available on the derivation of this criterion. The documentation demonstrates that is was derived from an oral study in mice in which the No Observed Adverse Effect Level was 6.4 mg/kg/day. A safety factor of 1000 was applied yielding the acceptable dose in humans of 0.0064 mg/kg/day. This was converted to an air concentration assuming 20 m^3 daily inhalation rate and 70 kg body weight. This yields 22.5 $\mu g/m^3$. It is applied in Ontario to 24-hour samples but scientifically, this is incorrect. It should be applied to annual average concentrations, not single 24-hour samples given that it is derived from a long-term toxicology study, not an acute toxicology study.

AMEC has derived a regulatory criterion from the same basic toxicological data for *subchronic* exposures, because the rodent toxicology study was a subchronic study. Subchronic exposures are defined by toxicologists as exposures that are weeks or months in duration versus chronic exposures that are exposures that are years in duration. For the purposes of this document, AMEC defines subchronic exposures as exposures that could be as short a duration as 15 days. This conservative definition of *subchronic* is assumed because the ATSDR's definition of acute exposures are exposures from one day to 14 days, and their definition of "intermediate" exposures, which is substantially similar to "subchronic" exposures is 15 days to one year.

The subchronic criterion is 225 $\mu g/m^3$ but there are uncertainties about the documentation for this study that Ontario MOE relied upon in 1987. Because of database uncertainties, AMEC believes that is it prudent to apply an additional safety factor of 10 when applying the criterion to the derivation of stop work criteria. The resulting criterion with the additional safety factor is 22.5 $\mu g/m^3$. As noted above, AMEC will conservatively assume that this subchronic criterion applies to exposures with durations as short as 15 days.

TABLE 15
SUMMARY OF SUBCHRONIC NO EFFECT LEVELS IN HUMANS FOR BENZENE

Criterion	Exposure / Averaging Time	Source
22.5 $\mu g/m^3$	15 days	Derived from Ontario MOE (1987) (no subchronic effect level for *sensitive* individuals x 0.1 additional safety factor)

To derive a fence line Stop Work criterion for a 24-hour period based on a community toxicological criterion that must be averaged over 15 days requires special consideration. Assuming that the air quality on the other 14 days during the 14-day period is at background (0.08 $\mu g/m^3$), the effect level in sensitive humans for the 24-hour period of interest is 336 $\mu g/m^3$ because this single day's value averaged with 14 days at local background concentrations equals 22.5 $\mu g/m^3$. Of course, in the unlikely event that the site experienced 14 days of heavy emissions in a row, then the fence line criterion would not have been protective enough. Because it is virtually impossible to hypothesize that site managers would allow high level emissions to be released from the site day after day for 14 days in a row, a protective but practical fence line criterion should be derived using a 24-hour target concentration in the community somewhere between 22.5

$\mu g/m^3$ and 336 $\mu g/m^3$. It is proposed here that the mid-point between these two boundary conditions be established as the appropriate effect level in sensitive humans over one 24-hour period based on the ATSDR 14-Day MRL. The midpoint is 179 $\mu g/m^3$. The total budget for 24 hour, 15-minute periods is calculated as

Community Budget	24 x 4 x 179 $\mu g/m^3$ = 17,184 $\mu g/m^3$-periods

To derive a community-based criterion for a 24-hour exposure period, one must take into account the fact the work will only occur for 8, 10 or 12 hours a day. This means that 32, 40, or 48 15-minute periods during the day are subject to site emissions due to work activities. The remaining 64, 56, or 48 15-minute time periods are assumed to be associated with background levels of naphthalene, which was cited as 0.08 $\mu g/m^3$ in the 2005 EIS (AMEC, 2005). Accordingly, a small fraction of the 24-hour budget of 17,184 $\mu g/m^3$-periods is consumed by ambient background levels in Sydney. The amount of the budget remaining for allocation to the work day is derived as follows for the 10-hour workday case:

Community Budget	17,184 $\mu g/m^3$-periods
(-) Background	56 x 0.08 $\mu g/m^3$ = 4.48 $\mu g/m^3$-periods
Workday Allocation	17,184 $\mu g/m^3$ – 4.48 $\mu g/m^3$ = 17,180 $\mu g/m^3$-periods

Workday allocations for 8-hour and 12-hour days are 17,179 $\mu g/m^3$ and 17,180 $\mu g/m^3$ respectively.

Budget Approach

The budget approach is defined by the workday allocations as noted above. This approach provides maximum flexibility and takes into account all possible scenarios of community concentrations over the course of a ten-hour period. When the budget is converted to fence line criteria taking into account dilution and dispersion and the PID sensitivity, the monitoring staff would simply need to add the 15-minute readings. Because downwind measurements are taken two times every hour, the workday allocation must assume that each actual 15-minute reading is assigned to a 30-minute period. Accordingly, the fence line budget for a monitoring program that involves two 15-readings during every 60 minute period is simply one-half of those calculated above assuming four 15-minute periods per hour. This ensures that each 15-measurement receives double weighting to ensure that the workday average is correctly calculated. If the total of any number of 15-minute readings assuming that two 15-measurements are taken every hour exceeded the fence line budget, the Stop Work order would need to be announced.

Workday Allocation Budgets

8-Hour Workday	8,589 $\mu g/m^3$
10-Hour Workday	8,590 $\mu g/m^3$
12-Hour Workday	8,590 $\mu g/m^3$

D. Derivation of Dilution/Dispersion Factors Between Fence Line and Community Receptors

As noted above, a conservative screening level air dispersion analysis was performed using the SCREEN3 dispersion model to determine dilution/dispersion factors considering all fence line locations and community receptor locations around the Tar Ponds for three time periods, 15 minutes to 8, 10 or 12 hours. As noted below, one conservative factor is used for all three potential work day lengths. The factor is:

- 3.33 for 15' to 8-12 hours

E. Derivation of Fence Line Stop Work Criteria For Benzene

To derive the fence line Stop Work criteria, one needs to take into account the expected dilution and dispersion between the fence line and the community receptor locations and the sensitivity of the PID meters to benzene. In addition, one needs to take into account the fact that four 15-minute measurements are not taken over the work day.

As noted above, the conservative dilution/dispersion factor for a 8-, 10-, or 12-hour period is 3.33. The conversion factor from $\mu g/m^3$ to ppm for naphthalene at 20 degrees Celsius is 5,240 $\mu g/m^3$ per ppm. The PID sensitivity for naphthalene is 0.45. The fence line Stop Work criterion is derived as follows:

> One-hour Budget of 150,000 $\mu g/m^3$ in the community summed over 2 consecutive 15-minute measurement periods (2 per hour x 1 hours) x 3.33 x (1/5,240) x (1/0.45) = 212 ppm summed over 2 consecutive 15-minute measurement periods.
>
> Eight-Hour Budget of 8,589 $\mu g/m^3$ in the community summed over 16 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/5,240) x (1/0.45) = 12 ppm summed over 16 15-minute measurement periods (8-Hour Workday)
>
> Ten-Hour Budget of 8,590 $\mu g/m^3$ in the community summed over 20 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/5,240) x (1/0.45) = 12 ppm summed over 16 15-minute measurement periods (10-Hour Workday)
>
> Twelve-Hour Budget of 8,590 $\mu g/m^3$ in the community summed over 24 15-minute measurement periods (2 per hour x 10 hours) x 3.33 x (1/5,240) x (1/0.45) = 12 ppm summed over 16 15-minute measurement periods (12-Hour Workday)

F. Implementation of Fence Line Stop Work Criteria For Naphthalene

The budget approach can be simply employed by having the monitoring team take 15-minute fence line PID readings and add them on a simple hand-held calculator or by manually adding the values as they are entered into a field notebook. Work can continue as long as the total for any one hour moving period (i.e. any two temporally adjacent 15-

minute measurement periods) does not exceed 212 ppm. However, one can never predict what the next reading will be, so practically speaking, on cannot employ the budget as is in the field. One needs to "hold back" some of the budget as insurance that the next reading will not take the total over the hour to a value that *exceeds* the budget.

Accordingly, it is proposed that the Stop Work criterion be set at 1/3 the allowable daily budget for any hour-long period. In essence, this approach assumes that the last reading before stopping work could be as high as 1/3 the budget regardless of the monitoring history for the day. Thus, implementation of the hour-long budget of 212 ppm requires that work be stopped when any single 15-minute measurement is 141 ppm. (212 ppm x 2/3 = 141 ppm.)

Similarly, the stop work criteria for 8-, 10-, and 12- hour days using a ½ "hold back" would be 8 ppm (12 ppm x 2/3 = 8 ppm).

G. Summary of Implementation of Fence Line Stop Work Criterion

Members of the residential communities in the vicinity of the Tar Ponds and Coke Ovens Sites can be protected against adverse health effects due to naphthalene exposure if fence line monitoring results are compared to the following Stop Work criterion regardless of the length of the work day.

- Stop Work if the result of any 15-minute measurement period (2 per hour) exceeds 141 ppm at any point during the day to ensure that a budget for any hour-long period does not exceed the fence line budget of 212 ppm.
- Stop Work if the daily running total of 15-minute measurement periods (2 per hour) exceeds 8 ppm at any point during the day to ensure that a daily fence line budget does not exceed 12 ppm

The approach is a flexible approach for monitoring work activities. The running budget approach explicitly takes into account the previous readings on any given day and also takes into account the uncertainty about the next reading that could follow on any given day by using a "hold back" provision. The use of the 8 ppm real time stop work criterion ensures that the total cumulative reading at the fence line on any given day does not exceed the work day budget of 12 ppm. Because the stop work criterion of 8 ppm running total is more conservative than the single measurement criterion of 141 ppm, the 8 ppm criterion governs.

H. Protectiveness of the Fence Line Stop Work Criterion

The real time fence line stop work criterion for naphthalene is derived with multiple layers of safety factors. This section briefly summarizes the assumptions and factors used to demonstrate that the criterion is more than adequately protective of human health.

1. A No Observed Adverse Effect level for acute effects is being used for the hour-long Stop Work criterion and a No Observed Adverse Effect level for subchronic effects is being used for the day-long Stop Work criterion.
2.The dispersion factor was derived using SCREEN3 screening level air dispersion model, which is a conservative screening level model that is recognized by all as providing conservative results.
3. The SCREEN3 model conservatively defaulted to meteorological data that are indicative of the most stable conditions (stability class 6 and a wind speed of 1.0 m/s). These conditions only occur during the night-time hours. Daytime atmospheric conditions result in a more turbulent atmosphere resulting in greater dispersion.
4. SCREEN3 was executed assuming that naphthalene was being released from the site as a constant source all day long, whereas any emissions that might occur would be intermittent at worst.

I. Derivation of Decision Criteria for Community Monitors

To assess chronic health effects, it is assumed that community monitoring will continue to be accomplished via the use of 24-hour sampling of community air. For compliance purposes, There are three available long term (chronic) toxicological criteria for naphthalene: (1) ATSDR Chronic Minimum Risk Level (MRL), (2) California Chronic Reference Exposure Level (REL), and (3) U.S. EPA Chronic Reference Concentration. One or more of these criteria can be used as a regulatory compliance criterion.

TABLE 16
CHRONIC TOXICOLOGICAL CRITERIA
NAPHTHALENE

Chronic Toxicological Criterion	Value
ATSDR Chronic MRL	3.7 µg/m^3 (lifetime)
California Chronic REL	9 µg/m^3 (lifetime)
U.S. EPA Chronic RfC	3 µg/m^3 (lifetime)

As noted above, the ATSDR chronic MRL is 3.7 µg/m^3, but the level associated with toxicological effects in the most sensitive humans is 37 µg/m^3. The California chronic REL is 9 µg/m^3, but the level associated with toxicological effects in the most sensitive humans is 94 µg/m^3. Lastly, the EPA chronic Reference Concentration is 3 µg/m^3, but the level associated with toxicological effects in the most sensitive humans is 93 µg/m^3. The most health-protective of these criteria including regulatory safety factors is the EPA Chronic RfC, 3 µg/m^3.

The 3 µg/m^3 criterion is applicable to lifetime exposure. In this case, the project activities are estimated for a duration of five or more years, so the period of interest is five years. However, it is common in the practice of risk assessment to average such values only over a single year despite the fact that there are acceptable levels for a lifetime exposure. Thus, the proposed project goal for naphthalene is an annual average concentration for a one-year period of 3 µg/m^3.

It is important to note that the 3 µg/m^3 Chronic RfC is *not* a value that must be met for every 24-hour canister. Instead, the project goal is to ensure that the one-year average concentration is less than 3 µg/m^3 for naphthalene. Many 24-hour canister samples can be higher than 3 µg/m^3 as long as ample canisters are less than 3 µg/m^3. AMEC notes that the monitoring schedule for the residential areas is one sample every sixth day. This means that there are five intervening days with no sample results. There are several ways to evaluate this censored dataset. One can assume that all five intervening days are similar to the higher of the two days with data. One can assume that all five intervening days are similar to the lower of the two days with data. When one of the two sampling days is a work day and one is not a work day, one can assume that all five intervening days are similar to the work day. One can assume that all five intervening days are similar to the average of the two days with data.

There are other approaches that could also be considered. However, *a priori*, there is no reason to expect that the work days that are monitored are systematically any different than the work days that are not monitored with community canisters. Accordingly, it is recommended that the annual average concentration be calculated by simply assuming that the running average of the monitored days is a reasonable estimate of the running average over the entire period, including the non-monitored days. On the other hand, it is a simple matter to calculate a running average using any one of several ways to estimate the concentrations at residential locations during non monitored days.

J. Verification of Protectiveness of Stop Work Criteria Regarding Regulatory Toxicology Criteria

The fence line Stop Work criteria are designed to ensure that the 15-day concentration in the community does not exceed 22.5 ug/m^3, which protects the community against subchronic toxic effects over a short time period with an added margin of safety of 100 by using the No Observed Adverse Effect Level instead of the Lowest Observed Adverse Effect Level and by adding an additional safety factor of 10 to account for database uncertainties. To ensure that the 15-day concentration in the community does not exceed 22.5 µg/m^3, the concentration during the 8-, 10-, or 12-hour work day cannot exceed 537, 429, or 358 µg/m^3, respectively. It should be noted, however, that the fence line Stop Work criterion is designed with an extra margin of safety (the “hold back” provision) to ensure that work is stopped before the subchronic toxicological criterion of 22.5 µg/m^3 in the community over a 15-day period is actually reached.

Specifically, because of the “hold back” factor used to derive the fence line Stop Work criterion of 12 ppm, work will be stopped when the concentration in the community over a 10-hour work day is actually no greater than 358, 286, or 239 µg/m^3 respectively (see Section E for discussion of the “hold back” factor.) At these work-day concentrations, the 15-day concentration in the community would be less than 22.5 µg/m^3. This is an additional protective factor that has been added because of uncertainty in the final measurement of the day before a Stop Work order might be given.

Before the fence line Stop Work criteria are adopted, it is important to verify that regulatory health-based criteria, which incorporate all regulatory margins of safety, are

satisfied if the Stop Work criteria are adopted. The most health protective of these regulatory health-based criteria includes the following:

- Chronic EPA RfC
  3 µg/m^3 over >365 days

The chronic EPA RfC is applicable for periods ranging from 365 days to a 70+ year lifetime. However, it is common risk assessment practice to average exposures over a period of no longer than one year when applying chronic health-based regulatory criteria. In this document, the chronic RfC will be assumed to be applicable 365 days and not 80 years, which is the Health Canada default risk assessment assumption for the lifetime of a Canadian citizen. Applying this chronic toxicological criterion to a one year time frame provides an additional margin of safety that ranges from 8 for 10-year exposure periods to 80 for one year exposure periods.

Chronic EPA RfC (3 µg/m^3 over 365 days)

The following example is given for the 10-hour work day scenario. Similar calculations can be shown for 8-hour or 12-hour work days.

Over a 365-day period, the target running total naphthalene concentration assuming a goal of 3 µg/m^3 over 365 days is 26,280 µg/m^3 -hours (3 µg/m^3 x 365 days x 24 hours/day = 26,280 µg/m^3 -hours). Over this same 365-day period, there are 235 work days and 130 non-work days (assuming a 6-day work week over a 9 month construction season), 10 work hours per day, and 14 non-work hours per day. Background for non-work hours and non-work days is 0.08 µg/m^3. Accordingly, the goal for the work-day hours can be calculated as follows:

Total goal for entire period:	26,280 µg/m^3 –hrs
Contribution over non-work days:	130 days x 24 hr/day x 0.08 µg/m^3 = 250 µg/m^3 -hrs
Contribution over work day nights:	235 days x 14 hr/day x 0.08 µg/m^3 = 263 µg/m^3-hrs
Contribution over non work hours:	(250 µg/m^3–hr) + (263 µg/m^3-hr) = 513 µg/m^3-hr
Remaining goal for work-day hours:	(26280 µg/m^3–hr) – (513 µg/m^3–hr) = 25767 µg/m^3–hr

The number of 10-hour work days that can exceed the fence line Stop Work criterion at any specific location and *not* exceed the chronic EPA RfC of 3 µg/m^3 over 365 days can be calculated as follows. As noted above, 286 µg/m^3 is the community concentration over a 10-hour work day associated with the stop work criterion for naphthalene.

(Exceedance Days) x (10 work hrs/day) x (286 µg/m^3) = 25,767 µg/m^3 –hrs
Exceedance Days = 25,767 µg/m^3 –hrs / {(10 work hrs/day) x (286 µg/m^3)}
Exceedance Days = 9 days

In essence, the Chronic EPA RfC of 3 µg/m^3 over 365 days will be met in the community if the fence line Stop Work criterion of 8 ppm (running total) over a 10-hour period is exceeded no more than 9 times every 365-day period *at a specific location.* As noted above, if during a calendar year period, there are five exceedances at a specific fence line monitoring location on the south side of the North Tar Pond (location A) and four exceedances at a specific fence line monitoring location on the north side of the South

Tar Pond (location B), this would not cause an exceedance of the Chronic EPA RfC, because exceedance of this regulatory criterion is location-dependent.

The probability that an exceedance will occur 9 times a year *at a specific location* cannot be predicted with accuracy. However, it is clearly very unlikely that this would ever occur. The probability of an exceedance is dependent on at least four factors, as noted above. While it may be possible to envision that over a year, the workers disrupt sediments containing naphthalene at high concentrations in an uncontrolled manner 9 times, that they might disrupt these sediments at worst case locations in terms of potential for dispersion 9 times in the year, and they might disrupt these sediments during temperature and humidity conditions that promoted volatilization 9 times a year, it is highly unlikely that these three conditions would overlap in time very many times, if at all. More importantly, it is extremely unlikely that this constellation of conditions would occur 9 times a year when the wind is consistently blowing the same direction during the entire day and *in that same direction* for the specific 9 days on which the unusually high levels of benzene emissions occurred.

As above, the probability that unusual meteorological conditions could occur 9 times a year can be assessed by consulting five years of the hour-by-hour wind data files used to perform air dispersion and deposition modeling. As shown in Tables 7-11, according to the actual Sydney wind data files, over a five year period of meteorological data, there are only 3-7 instances per year during the five year period in which the wind was blowing the same direction defined as a 22.5% sector over the course of a 10-hour work day (7 am to 5 pm) and 0 instances in which the wind was blowing that same specific direction 9 times within a single year.

This simple exercise demonstrates that the use of the fence line Stop Work criteria for naphthalene proposed here are adequately protective of acute toxicological effects in sensitive members of the population that live in the nearby residential areas and also adheres to the Chronic EPA RfC, a regulatory criterion derived with the full use of regulatory safety factors.

K. Summary of Fence Line and Community Criteria For Naphthalene

The criteria for naphthalene are summarized below.

TABLE 17
SUMMARY OF FENCE LINE AND COMMUNITY CRITERIA FOR NAPHTHALENE

Criteria Type	**Criteria for Real-Time Fence Line Monitors (PID Meters)**
Stop Work (PID)	Running daily total of 8 ppm

Criteria Type	**Criteria for 24-hour Community Monitors (Laboratory Data)**
Regulatory Compliance	Calendar Year Annual Average: 3 µg/m^3

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