ADDRESSING TRACE METAL AND PETROLEUM HYDROCARBON CONTAMINATION ON BROWNFIELD PROPERTIES

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NSEIA-ATLANTIC PIRI
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OVERVIEW

- WHAT IS A BROWNFIELD?
- IMPEDIMENTS TO RE-DEVELOPMENT
- CASE EXAMPLE
- WORKING OUR WAY THROUGH
- SUCCESS AT LAST
- LESSSONS LEARNED
- CONCLUSIONS

WHAT IS BROWNFIELD DEVELOPMENT?

- INNER CITY
- INDUSTRIAL /COMMERCIAL HISTORY
- VIEWED AS “CONTAMINATED”.
- LOW-VALUE CURRENT USES.
- POTENTIAL HIGHER VALUE.
- USE EXISTING INFRASTRUCTURE WITHOUT FURTHER INVESTMENT.
- CATALYST FOR AREA RE-DEVELOPMENT AND RENEWAL.

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EXAMPLES OF BROWNFIELDS PROJECTS IN HALIFAX

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IMPEDIMENT TO BROWNFIELD DEVELOPMENT #1:

MANAGEMENT OF SITE GEOCHEMISTRY

AFTER REMOVING THE MORE OBVIOUS “CONTAMINANTS”

HOW TO ADDRESS PETROLEUM HYDROCARBONS IN SOIL & GROUNDWATER ?

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OUTCOME #1:

- USE ATLANTIC RBCA PROTOCOL.
- LESS THAN TIER 1 VALUES = “ACCEPTABLE” RISK.
- GREATER THAN TIER 1 VALUES = “RISK MANAGED”.
- RISK MANAGEMENT REQUIRES MORE TECHNICAL ASSESSMENT AND MATERIAL MANAGEMENT, BUT ALLOWS PROJECT TO PROCEED.

BUT,

HOW TO DEAL WITH PROPERTIES IMPACTED BY HYDROCARBONS + METALS ?

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SCOPE OF TRACE METALS ISSUE IN HALIFAX PROPERTIES

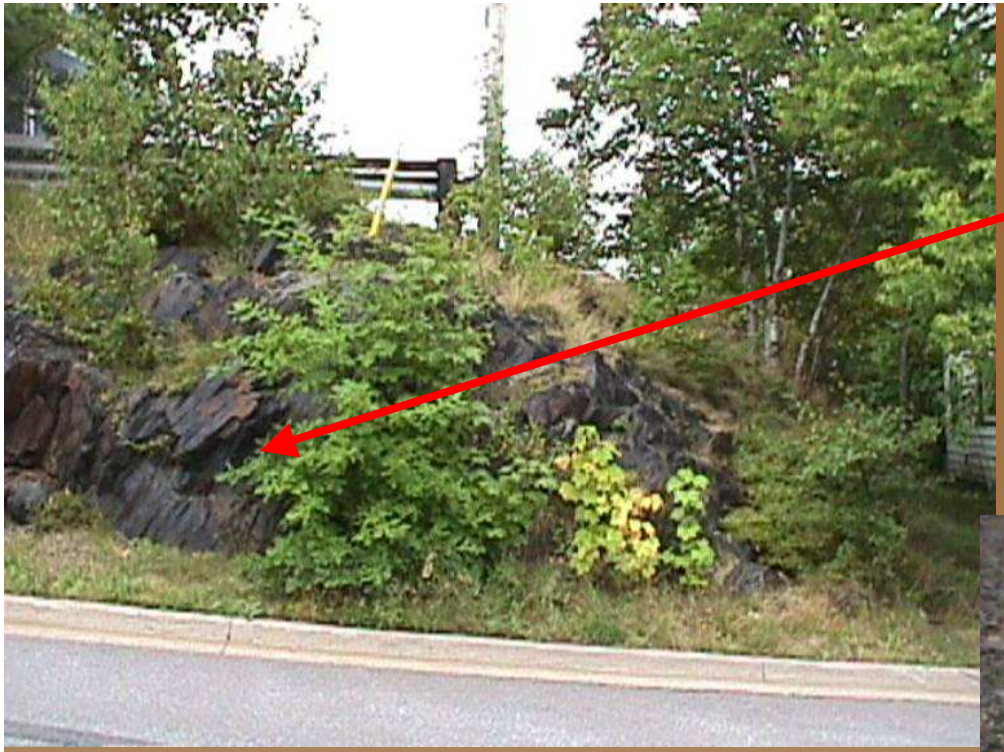
	CCME R & C	McNAB'S ISLAND (1)	QUARTZITE TILL (2)	SLATE TILL (2)	HALIFAX AVG.
ARSENIC	12 & 12	22	32	43	38
LEAD	140 & 260	71	99	172	430
ZINC	200 & 360	133	199	150	310
COPPER	63 & 91	120	135	109	<50

1. JACQUES WHITFORD ENVIRONMENT LTD. 1992. ENVIRONMENTAL ASSESSMENT REPORT FOR HALIFAX-DARTMOUTH SEWAGE PROJECT. REPORT TO HALIFAX HARBOUR CLEAN-UP CORP.

2. R.R. STEA AND J. H. FOWLER. 1979. MINOR AND TRACE METAL VARIATIONS IN WISCONSINAN TILLS, EASTERN SHORE REGION, NOVA SCOTIA. N. S. DEPT. OF MINES AND ENERGY PAPER 79-4.

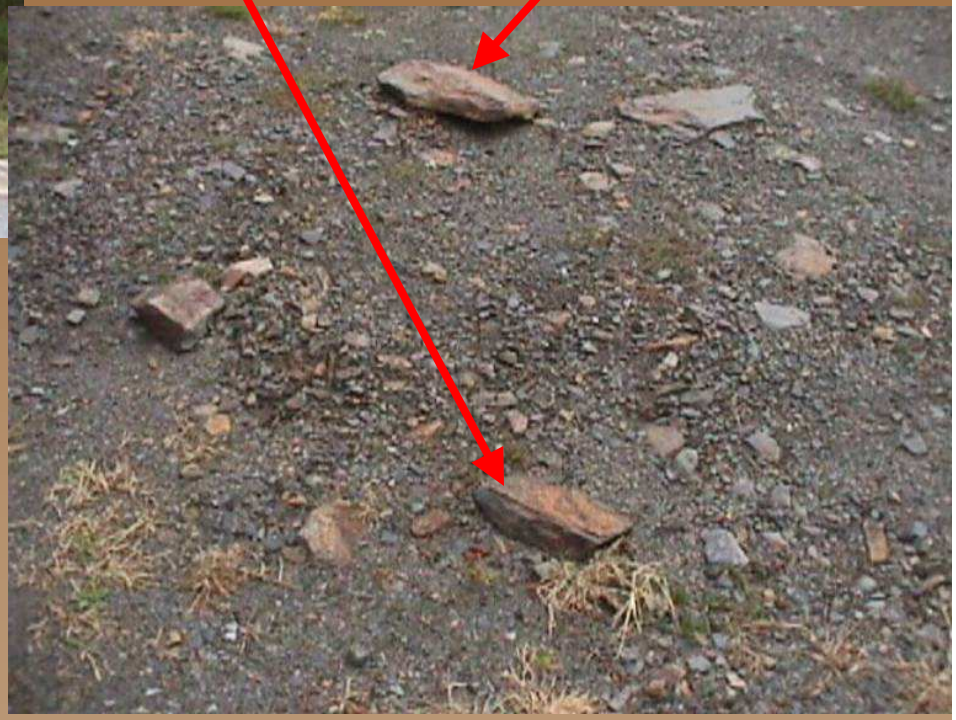
SOURCES OF TRACE METALS

- **NATURAL:**
  - **MEGUMA GROUP/HALIFAX FORMATION PYRITES OR ARSENO-PYRITES AS BEDROCK AND PART OF OVERLYING "SOIL".**
- **ANTHROPOGENIC (MOSTLY SINCE 1749):**
  - **COAL ASH AND CLINKER DISPOSAL AS DRIVEWAY AND ROAD MATERIALS**
  - **HALIFAX EXPLOSION**
  - **LEADED GASOLINE AS LEAKED PRODUCT**
  - **MANUFACTURING WASTES (BETWEEN 1880 AND 1945)**
  - **SAND BLASTING OF LEAD-BASED PAINT**
  - **HANDLING OF LEAD BATTERIES**



TYPICAL OUTCROP OF PYRITIC SLATE

TYPICAL OCCURRENCE OF PYRITE



MOST EXPOSED PYRITE IN CAPITAL BUSINESS DISTRICT – LOCATION OF MANY POTENTIAL BROWNFIELD DEVELOPMENTS.

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WHAT TO DO AND STILL ACHIEVE DEVELOPMENT?

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CASE EXAMPLE:
6116 ALMON STREET HALIFAX, NS

JULY/1999

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"CLASSIC" BROWNFIELD PROJECT BY PRIVATE DEVELOPER

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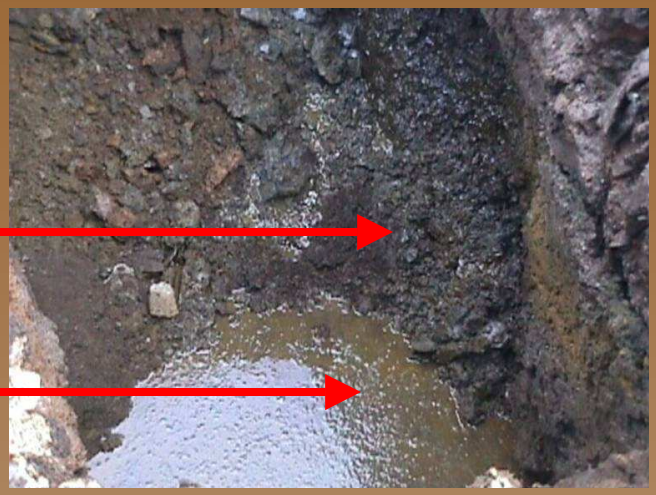
ASSESSMENT ISSUES

- SOIL AND GROUNDWATER HYDROCARBON IMPACTS.
- AST'S CONTRIBUTING TO HYDROCARBON IMPACTS.
- METAL IMPACTS.
- CONCRETE SLAB REMNANTS.
- IMPACTS FROM ADJACENT INDUSTRIAL PROPERTIES.



CONTAMINANT PROFILE -TRACE METALS

TP Depth (m)	0.5-0.8	0.8-1.1	0.5-0.75	0.25-1.0	0.2-0.4	Site Average	CCME Res.
Arsenic	32	38	30	38	33	36	12
Lead	160	120	260	240	410	236	140
Zinc	990	620	190	170	1500	675	200

CONTAMINANT PROFILE -PETROLUEM HYDROCARBONS

DEPTH (m)	BTEX	TPH
1.9	4.61	6990
0.25	1.51	486
1.2-1.4	1.42	6810
0.2-1.0	4.23	455
1.6-1.9	<1	<32.5

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RISK EVALUATION USING ATLANTIC RBCA (V-1.0) - #1

- COMPOUNDS OF CONCERN: BTEX, + TPH + CARCINOGENIC PAH's + TRACE METALS (As, Pb, Cu, Zn).
- METAL SCREENING VALUES TAKEN AS CCME RESIDENTIAL
- REMOVE As FROM COC LIST BECAUSE CONCENTRATIONS WITHIN "BACKGROUND" OF 38 mg/kg.
- BTEX+TPH+PAH's+Pb+Zn

RISK EVALUATION USING ATLANTIC RBCA (V-1.0) - #2

- **RECEPTORS: CONSTRUCTION WORKERS + RESIDENTS.**
- **ROUTES: AIR (INDOOR & OUTDOOR) + DIRECT SOIL CONTACT + INGESTION (DURING & AFTER CONSTRUCTION).**
- **INPUTS: REPRESENTATIVE CONCENTRATIONS**
- **TOX VALUES CHECKED BUT NOT SEGREGRATED BY RECEPTOR ORGANS.**
- **ADD Pb TO ATLANTIC RBCA.**

RISK EVALUATION USING ATLANTIC RBCA (V-1.0) - #3

RISK-HAZARD CHARACTERIZATION:

- **BENZENE + CARCINOGENIC PAH's**
- **TPH + Pb + Zn**
- **ADD CONCURRENTLY ACTIVE ROUTES.**
- **CUMULATIVE TOTAL (APPLICABLE GROUPS OF COMPOUNDS/ROUTES).**
- **ALL FACTORS INCLUDED IN ATLANTIC RBCA.**

***RISK-HAZARD IS ACCEPTABLE*.**

RISK EVALUATION USING ATLANTIC RBCA (V-1.0) - #4

NSDEL FEEDBACK:

- **ATLANTIC RBCA ONLY FOR HYDROCARBONS.**
- **EVALUATE RISK FOR METALS BY OTHER CALCULATIONS.**
- **ASSUME SAME PROCESSES, ROUTES AND CONCURRENTLY ACTIVE EXPOSURES.**

% OF HUMAN HEALTH REFERENCE DOSE FROM EXPOSURE TO SITE SURFACE SOILS

SCENARIO	1	2	3	4
ARSENIC	120	15	102	12
LEAD	81	10	68	8
ZINC	2	<1	2	<1

EVALUATION OF RISK DUE TO METAL IMPACTS

- ARSENIC RISK CONSIDERED ACCEPTABLE BASED ON TYPICAL VALUES FOR MEGUMA FORMATION SLATES AND TILL.
- LEAD AND ZINC HAZARDS WITHIN ACCEPTABLE RANGE FOR HUMAN HEALTH EXPOSURE.
- SUM OF LEAD, ZINC, (PLUS BTEX AND TPH FRAC'S) HAZARDS ARE LESS THAN TARGET HAZARD OF 1.0

RISK EVALUATION USING ATLANTIC RBCA (V-1.0) - #6

KEY FINDING: HAVING METALS IN OR OUT OF THE ATLANTIC RBCA GAVE SAME RISK-HAZARD CHARACTERIZATION VALUE – AND THE SAME CONCLUSION OF AN ACCEPTABLE RISK.

FINDINGS INFLUENCED PROJECT

- ❑ IMPACTED SOILS RETAINED ON SITE.
- ❑ BUILDING DESIGN AND CONSTRUCTION MODIFIED.
- ❑ UNDERGROUND SERVICE ROUTES ADJUSTED.
- ❑ "HARD COVER & LANDSCAPING" ISOLATE IMPACTED SOILS.

BOTTOM LINE:

- ***PROJECT PROCEEDS***
- ***PROJECT COSTS CONSIDERABLY REDUCED.***

LESSONS LEARNED:
IF DOING PROJECT TODAY

- SEGREGATE COMPOUNDS BY TOX TARGET ORGAN (i.e., 1E-05 FOR BENZENE, OR PAH'S, OR As).
- USE CRITICAL PATHWAY ONLY IF TOX INFO JUSTIFIES DIFFERING TARGET ORGANS OR SYSTEMS.

CONCLUSIONS - 1

- **ATLANTIC RBCA APPLICATIONS CURRENTLY FOCUS ON HYDROCARBON IMPACTED SOIL AND GROUNDWATER.**
- **MANY HALIFAX BROWNFIELD SITES ALSO HAVE CONCENTRATIONS OF TRACE METALS EXCEEDING CCME 1999 GUIDELINES, DUE TO NATURAL SOURCES (e.g., As >12 mg/kg).**
- **SITE SPECIFIC RISK MANAGEMENT PROTOCOLS CAN BE DEVELOPED FOR TRACE METALS TO PERMIT DEVELOPMENT.**

CONCLUSIONS - 2

- TRACE METAL RISK ASSESSMENT EVALUATIONS CAN OFTEN BE INCORPORATED INTO ATLANTIC RBCA PROTOCOL (PREFERABLY WITH TOX-BASED SEGREGATED RISK/HAZARD TARGETS).
- INCORPORATION WOULD BETTER ENSURE CONSISTENCY IN APPROACH TO REMEDIATION.
- INCORPORATION WOULD BETTER ENSURE ALL SITE RISKS ARE ADEQUATELY EVALUATED AND ADDRESSED.

THANK YOU

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