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FINAL DECEMBER 2008 TECHNICAL MEETING NOTES AND AGENDA WITH TRANSMITTAL LETTER NAS BRUNSWICK ME

2/2/2009

BRAC PMO NORTHEAST

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE, NORTHEAST
4911 SOUTH BROAD STREET
PHILADELPHIA, PA 19112-1303

5090
BPMO NE/TB
Ser 09-083
February 2, 2009

Mr. Michael J. Daly
Remedial Project Manager
Federal Facilities Superfund Section
U.S. Environmental Protection Agency (EPA)
1 Congress Street, Suite 1100 (HBT)
Boston, MA 02114-2023

Ms. Claudia Sait
Remedial Project Manager
Maine Department of Environmental Protection (MEDEP)
Bureau of Remediation and Waste Management
17 State House Station
Augusta, ME 04333-0017

Dear Mr. Daly and Ms. Sait:

Enclosed you will find the Final December 2008 Technical Meeting Notes, Naval Air Station (NAS) Brunswick, Maine. These notes are provided for your use/reference.

If you have any questions or comments, please contact the Navy's Remedial Project Manager, Todd Bober at (215) 897-4911.

Sincerely,

Paul F. Burgio
BRAC Environmental Coordinator
By direction of BRAC PMO

Enclosure:
Final December 2008 Technical Meeting Notes, NAS Brunswick, Maine

Copy to:
MEDEP (C. Evans)
Gannet-Fleming (D. McTigue)
NASB (L. Joy, M. Fagan, J. James)
Lepage Environmental (C. Lepage)
NAVFAC MIDLANT (T. Bober)
NAVFAC ATLANTIC (J. Wright, B. Capito)
TtNUS (L. Klink, C. Race, J. Orient)
ECC (A. Easterday, G. Calderone, C. Guido, R. Phinney)
Curtis Memorial Library (J. Fullerton)

Copy to: (w/o encl)
BRAC PMO NE (P. Burgio)
NAVFAC ATLANTIC (D. Barclift)
BACSE (E. Benedikt, C. Warren)
CO NASB (CAPT Fitzgerald)
RAB Brunswick Representative (S. Johnson)
RAB Harpswell Representative (D. Chipman)
RAB Topsham Representative (S. Libby)
MRRA (V. Boundy)

December 2008
Technical Meeting Agenda
Naval Air Station Brunswick
Parkwood Inn
Brunswick, Maine

Tuesday 2 December (1:00-5:00)

1:00 – 1:15 **Meeting Logistics/Administrative (All)**

1:15 – 1:45 **Community Items (Navy)**
- Site Management Plan
- Fall Newsletter, Administration Record/Distribution
- RAB Charter
- Document Distribution

1:45 – 2:30 **Proposed Upcoming Work (Navy)**
- List/Schedule (Future Schedule)
- Plans for 2009
- Backup plans if money becomes available (Prioritization of Future Work)
- Coordinating with MRRA priorities
- Emerging contaminants

2:30 – 3:00 **Potential Sites (Navy)**
- Plans for known sites
- Encouraging disclosure from Public
- Tracking status – BETS
- Weapons Compound

3:00-3:15 **Break**

3:15 – 3:45 **Bedrock Investigation (TtNUS)**
- Overview/Status
- Abandoning bedrock well MW-308 – Revisit with new data

3:45 -4:30 **Eastern Plume (ECC/TtNUS)**
- Groundwater model status (ECC)
- Offsite residential well analytical results – fall 2008 (ECC)
- 1,4-Dioxane investigation overview (TtNUS)
- 2008 Profiling and transect data

4:30 -5:00 **Site 17 (ECC/TtNUS)**
- Removal action status/next steps (ECC)
- Site 17 Remedial Investigation status (TtNUS)
- Focused FS Planned for Spring Summer 2008

Wednesday December 3 (8:30-12:00)

8:30-9:00 **Picnic Pond Area of Concern Evaluation (Navy)**
- Purpose of evaluation
- Sampling Program Completed
- Report Due Out Winter 2009

9:00-9:15 **NEX (Navy)**
- Summary of Fall Pre-design Analytical Data (if available)
- Next Steps (Data Summary, Construction Workplan)

9:15 – 9:30 **Site 7 (TtNUS)**
- Previous PCB data (TtNUS)
- Proposed Sampling Program Scheduled for December

9:30-10:00 **ONFF** (**ECC)**
- History & Status of Program
- October sampling results
- Current Approach for Site Assessment

10:00 – 10:30 **Site 9 (ECC)**
- Ash delineation area north scheduled for Dec. 2008
- Removal action/closure report (Not available yet)
- Building 201 AOC – next steps

10:30-11:00 **Military Munitions Response Program (MMRP) (TtNUS)**
A. MEC Study Results- Summer 2008 & Munitions Clearance Requirements
B. Munitions Constituents (MC) Program Status

11:00– 11:30 **Site 2 (TtNUS)**
- Investigation overview & Site Conceptual Model
- Analytical results (if available),
- Geophysical results & boring log data
- Next steps

11:30 – 12:00 **Background Work Plan –** (**TtNUS)**
- Goals
- Field Program Scheduled for 2009
- Map of some proposed background locations

12::00 **Adjourn**

TECHNICAL MEETING
NAVAL AIR STATION BRUNSWICK, MAINE
2 - 3 DECEMBER 2008
MEETING NOTES

MEETING ATTENDEES

Todd Bober, Remedial Project Manager	U.S. Navy, MIDLANT
Paul Burgio, BRAC Environ. Coordinator	U.S. Navy, BRAC PMO Northeast
Claudia Sait, Remedial Project Manager	Maine Department of Environmental Protection
Ted Wolfe, Program Manager	Maine Department of Environmental Protection
Chris Evans, Geologist (3 Dec. only)	Maine Department of Environmental Protection
Mike Daly, Remedial Project Manager	U.S. Environmental Protection Agency
Stacey Greendlinger, Community Relations	U.S. Environmental Protection Agency
Al Easterday, Project Manager	ECC (Navy Contractor)
Gina Calderone, Project Manager	ECC (Navy Contractor)
Lisa Joy, Environmental Director	Naval Air Station Brunswick
Michael Fagan, IR Coordinator	Naval Air Station Brunswick
John James, Public Affairs (2 Dec. only)	Naval Air Station Brunswick
Jennifer Wright, Biologist	U.S. Navy, NAVFAC LANT
Carol Warren	Brunswick Area Citizens for a Safe Environment
Victoria Boundy, Planner	Mid-Coast Regional Redevelopment Authority
Carolyn Lepage, BACSE Tech Advisor	Brunswick Area Citizens for a Safe Environment
Linda Klink, Project Manager (3 Dec. only)	TetraTech NUS (Navy Contractor)
Chuck Race, Project Manager/Geologist	TetraTech NUS (Navy Contractor)
Jeff Orient, Program Manager	TetraTech NUS (Navy Contractor)
David Chipman, RAB Member	Town of Harpswell, Maine
Josh Katz (2 Dec. only)	Brunswick Area Citizens for a Safe Environment
Ed Benedikt	Brunswick Area Citizens for a Safe Environment

2 DECEMBER 2008

Meeting began at 1300 hours at the Parkwood Inn in Brunswick, Maine. The sign-in sheet is provided as Attachment A. Meeting presentations are provided in Attachment B. Handouts are provided in Attachment C.

1. Meeting Logistics/Administrative (Navy)

The meeting attendees set up the proposed RAB (Restoration Advisory Board) meetings for 2009. Paul indicated that other meetings during 2009 will be held when necessary. The Navy's two contractors (ECC and TtNUS) have set up file transfer protocol (ftp) websites where documents can be downloaded by the public. The purpose of these sites is to allow everyone access to the project deliverables.

2. Community Items (Navy)

Paul indicated that the Site Management Plan, Fall 2008 Newsletter, and RAB Charter were completed. The Site Management Plan was issued as Final and Navy indicated that the plan will be updated as needed and not revised on a set schedule. The Administrative Record will be updated periodically with final documents. The RAB Charter will be signed by all parties at the December 2008 RAB meeting and will be placed into the Administrative Record. Carol indicated that she has a list of about 10 documents that she would like to have for review. Mike Daly distributed the EPA (Environmental Protection Agency) Fish Study to meeting attendees. Navy acknowledged and appreciated the expedited regulator reviews and involvement with field sampling location designations (i.e., Picnic Pond) for several of the recent site field sampling efforts.

3. Proposed Upcoming Work (Navy)

Todd went over the 2009 schedule of upcoming work at the Naval Air Station (NAS) Brunswick. The topic of funding and prioritization was discussed specifically for Site 17, Old Navy Fuel Farm (ONFF), and Site 7 concerning potential removal actions. Todd indicated that they request funds for these types of actions, as they are needed. The funding is not guaranteed, but early notice helps obtain funding if funds become available during the fiscal year. Todd presented a rough 2009 'Wish List' for 2009 through 2010 which includes Site 17, Site 9, Site 7, and the Quarry Sites Munitions clearances. Carol would like to see another extraction well installed in the southern boundary area of the Eastern Plume. There was discussion regarding the new data being collected at the Eastern Plume for the Remedial Investigation Report for 1,4-dioxane and the groundwater model which will allow the Navy to update the site conceptual model for the Eastern Plume. The Navy noted that a 'Tiger Team' is evaluating the Eastern Plume site and their findings will be used for optimization of the extraction system and treatment options for the Eastern Plume.

The Navy outlined the procedure that will be followed to look at emerging contaminant (EC). The Navy will use the Department of Defense (DOD) protocol/checklist for EC. Paul provided a hand out on this topic to meeting attendees (Attachment C). Claudia added that the EPA's Emerging Contaminant list is very complete and more geared towards remediation and applicable to a clean-up program. Claudia indicated that the DOD list is more geared for chemical handling. Navy's position is not to randomly check for emerging contaminants, but rather to use site knowledge, technical and scientific results, and best judgment to decide what emerging contaminants to screen for.

4. Potential Sites (Navy)

Navy discussed the following five off-base Base Realignment and Closure (BRAC) sites:

- Small Point Rake Station– The Navy and EPA and MEDEP visited the site in November 2008 and the Navy is preparing a Technical Memo for the site. It is privately owned and not included in the Environmental Impact Statement (EIS). The Navy intends to transfer this property as soon as possible. Property transfer is tentatively scheduled for Summer 2009. Lead in soil is the only environmental concern at this site.

- Sabino Hill Rake Station– Navy will demolish the tower at the site. Transfer can occur after completed EIS Record of Decision (ROD) is signed. Property transfer is tentatively scheduled for Spring 2010. Lead based paint on the tower is the primary environmental issue at site.
- East Brunswick Radio Tower – A 20 acre site. This parcel is included in the EIS and the property can be transferred after the EIS ROD is signed. Property transfer is tentatively scheduled for Spring 2010. Future use of this parcel is planned for conservation and recreation.
- Topsham Annex – Environmental Assessment (EA) will be completed in the next 6 months. Marines are still located at Topsham. This parcel is not included in the EIS. Marine buildings have piping and UST (underground storage tank) issues. A partial removal action was completed. Public/Private Venture (PPV) owns buildings; property owned by Navy. Property transfer is tentatively scheduled for Spring 2011.
- McKeen Street Housing – This property is included in EIS. A PPV owns the building and the property owned by Navy. Property transfer is tentatively scheduled for 2011.

Encouraging disclosure from public, the Navy wants to encourage flow of information from the public in any form possible. The Navy indicated that they would not have a formal form or process, but would try to make the process transparent. The question of restricting site access after the Navy has left the base was asked. Navy and EPA stated that site restrictions are part of the Finding of Suitability to Transfer (FOST) or the Finding of Suitability to Lease (FOSL) process. The Navy will still have to pay for, and conduct Long-Term Monitoring (LTM) and ensure that the institutional controls (IC) are being maintained.

The Navy updated the meeting attendees on the BRAC (Base Realignment and Closure) Environmental Tracking System (BETS), which is a database system with web and GIS (Geographical Information System) based tools for stakeholders to use. MEDEP suggested a newspaper article encouraging people to come forward with information. The Navy is trying to have it ready sometime in 2009. However, Paul indicated that the top priorities are to clean-up the IR (Installation Restoration) sites.

Weapons Compound – The Base's mission is still ongoing. Once the squadrons leave, an assessment of the weapons area can begin. The MEDEP (Maine Department of Environmental Protection) inquired about the past uses of the building and if nuclear weapons may have been stored in that building(s). Lisa indicated she would bring this topic to the Navy department heads meeting.

5. Bedrock Investigation (TtNUS)

Chuck Race provided a presentation with an overview of this project, showing the locations of the 3 groundwater monitoring well locations, (1 overburden and 2 bedrock) in the vicinity of monitoring well MW-308. These wells were completed as well couplets. MEDEP asked if these new wells could be ready for the Spring 2009 LTM sampling event. The Navy indicated that this should be possible. The decision to abandon the well will be based on the new data and stakeholder review/discussion.

6. Eastern Plume (TtNUS)

The groundwater model for the Eastern Plume was issued draft to stakeholders and is currently in review by the regulators. The residential well was sampled in Fall 2008 and was non-detect for both volatile organic compounds (VOCs) and 1,4-dioxane.

The 2 December 2008 meeting adjourned for the afternoon at 1700 hours.

3 DECEMBER 2008

The Technical Meeting resumed at 0845 hours.

7. Site 17 (TtNUS)

Chuck provided a brief overview of the Remedial Investigation (RI) at Site 17. Phase II of the RI will consist of collecting groundwater samples from the new wells (2) and existing wells (5). A total of 72 soil samples were collected and analyzed for pesticides, herbicides, metals, cyanide and DRO (diesel range organics) during Phase I of the RI. Chuck indicated that the soil data should be available in January 2009. Claudia asked to see the new data before Phase I is completed. The intent is to bound the site impacted area. Chuck indicated once the data is validated he would be able to issue the data. Chuck discussed a black layer which may be associated with black sludge by septic leach field or a natural peat layer. The layer revealed an elevated flame ionization detector (FID) reading but no photoionization detector (PID) reading.

8. Site 7 (TtNUS)

Chuck provided a brief on Site 7 Assessment task. The approach is to grid the site for direct-push soil sampling and utilize x-ray fluorescence (XRF) screening of soil for cadmium and manganese. Some of the soil samples will also be analyzed for polychlorinated biphenyls (PCBs). Once the analytical data is available, the draft Sample and Analysis Plan (SAP) will be prepared for review and stakeholder input. Field work for this effort is planned for the Spring 2009. There was discussion by Claudia regarding a figure that indicated that this site was once used as a metal dump. Therefore, the site may have been more than just a Defense Reutilization and Marketing Office (DRMO) lay down area. Previous investigations showed that corrugated metal is present at the site. Todd indicated that the Navy is trying to keep Site 17 and Site 7 tasks executed in parallel. Each of these two sites may require public meetings for an Explanation of Significant Difference (ESD). Site 7 and Sites 17 may require a Proposed Remedial Action Plan/Record of Decision (PRAP/ROD). Site 7 is a high priority for the Navy and the Background Study data will be used to review and evaluate Site 7.

9. Site 2 (TtNUS)

Chuck reviewed the field tasks that have been completed to date at Site 2 including the EM-61 survey, test pits, soil borings, and well installations. The well elevation survey will be finished in a couple weeks. Ash was found around a foundation that was suspected to be the former incinerator. Ash was also found in the area east of the foundation. Test pits were dug in these areas. Claudia asked if anything unusual was found along the embankments. Chuck indicated only a little asphalt, but nothing else significant or unusual was identified during execution of the field tasks. Paul suggested the use of the ftp site to provide preliminary data to the stakeholders once it is available.

10. Military Munitions Response Program Sites (TtNUS)

Linda provided on overview of the Military Munitions Response Program (MMRP) sites. At Site 12, there were 161 anomalies found. There were numerous low level hits at the Munitions Bunker West Area. The Bunker will be included in the Resource Conservation Recovery Act (RCRA) closure process. One rocket motor was discovered and 268 anomalies. Linda discussed the composite soil sampling EPA Method 8330B and Multi-Incremental Sampling (MIS) for the Munitions Constituents (MC) sites and pros and cons of each method.

- For Skeet Range – MIS not recommended.
- For Quarry Site – MIS not recommended.
- Former Munitions Bunker West – Suggested to consider MIS in grid fashion

Linda sought to obtain agreement on Work Plans now rather than to prepare revised Work Plans and sampling methods/laboratory methods and then need to revise the Plans over again. She suggested breaking up the Work Plans into site specific work plans. The group discussed that post anomaly investigation sampling may result in collecting disturbed samples. The Navy wants to execute the MEC (munitions and explosives of concern) work first then proceed with the MC sites. Navy stated that safety comes first at the munitions sites and that each site must be have clearances prior to any sampling or intrusive work.

11. Background Work Plan (TtNUS)

Jeff provided an overview of the Background Work Plan that is being re-issued as a Draft Work Plan. Seven background areas were identified on Base. The regulators and Navy are planning to conduct a site visit to look at each of the seven background locations on the base. Jeff went over the technical approach for the Background Study and the number of samples per sample matrix, such as surface soils, subsurface soil, seeps, surface water, and groundwater (bedrock and overburden). Todd discussed the Background Study schedule and what the Navy is trying to achieve for execution of the study. The Navy wanted to issue the final Work Plan in February 2009; however, there is not sufficient time for regulatory review of the draft work plan and site walks between December 2008 and January 2009 to revise and issue a final work plan in February 2009. The Navy emphasized that the Background Study is a high priority for them and is an important part of the BRAC process. Mike Daly stated that he wants to have additional EPA technical resources with him during the site walks at each of the seven areas. The Navy will coordinate the site visit schedule with their contractor and come back to the regulators with revised schedule for the Background Study site visits.

12. Old Navy Fuel Farm (ECC)

Al provided an overview of the status of Old Navy Fuel Farm (ONFF) and the October 2008 sampling results. There was discussion on an appropriate sampling analysis for petroleum hydrocarbons to differentiate between naturally occurring carbon and diesel range organics. The Massachusetts Extractable Petroleum Hydrocarbon (EPH) Method and the silica gel treatment which filters out non-fuel biogenic polar compounds (natural occurring) was discussed with MEDEP. The best approach and sampling method and clean-up goal for ONFF will continue to be discussed with MEDEP during the next couple of months.

13. Site 9 (ECC)

An overview of the scheduled field investigation in the north area of Site 9 and status of the replacement groundwater monitoring wells for the Site's Long-Term Monitoring Program were discussed. There was discussion regarding VOC detections in monitoring wells MW-NASB-227 and S9-01 which are cross-gradient of the site.

14. Picnic Pond Area of Concern Evaluation (Navy)

Todd briefed the meeting attendees on the Navy's Picnic Pond sediment sampling effort in November 2008. No sampling data is available yet. The sampling effort was a screening level effort for now and will be re-assessed once data is reviewed. After review of the data, if necessary, the Navy will develop a plan for action at the site. The Navy, EPA and MEDEP representatives conducted a site walk in November 2008. The Navy appreciated and noted the regulators quick action on the Navy's request for a site walk and review of the proposed sampling method.

Meeting adjourned at 1235 hours.

ATTACHMENT A:
SIGN-IN SHEETS

Sign-In Sheet
Technical Meeting
Naval Air Station
Brunswick, Maine
Parkwood Inn
Tuesday, 2 December 2008

NAME	ORG
AL EASTERDAY	ECC
Gina Calderone	ECC
LISA JOY	NASB ENV
David W. Chipman	Town of Harpswell
Claudia Sait	MEDEP
Victoria Boundy	MRRA
Mike Daly	US EPA Reg I
Stacy Greendlinger	US EPA
John James	NASB Public Affairs
Carol Warren	BACSE
Carolyn Lepage	BACSE Tech Advisor
TED WOLFE	MEDEP
CHUCK RACE	TTNUS
JEFF ORIENT	TTNUS
TODD BOBER	NAVY
PAUL BURGIO	NAVY
MIKE FAGAN	NASB ENVIRO
JOSH KATZ	BACSE
Ed Benedikt	BACSE
Jen Wright	NAVFAC Atlantic

Sign In Sheet
Technical Meeting
Naval Air Station
Brunswick, Maine
Parkwood Inn
Wednesday, 3 December 2008

NAME	ORG
AL BASTENDAY	ECC
Gina Calderone	ECC
Mike Daly	USEPA
TODD BOBER	NAVY
Stacy Greendlinger	US EPA
Carol Warren	BACSE
David W. Chipman	Town of Harpswell
Victoria Boundy	MRRA
Chris Evans	MDEP
Claudia Sait	"
Ted Wolfe	MEDEP
JEFF ORIENT	TTNUS
LINDA KLINK	TENUS
PAUL BURGIO	NAVY
Chuck Race	TTNUS
LISA JOY	NASB ENV
Jen Wright	NAVFAC Atlantic
Ed Benedikt	BHCS

ATTACHMENT B:
PRESENTATIONS

PRESENTATIONS

Community Items

- **Site Management Plan –** Completed – Nov 08.
- **Fall Newsletter –** completed – Nov 08 -on NASB website and available at RAB meeting.
- **Admin Record –** will be updated Jan 09.
- **RAB charter –** submitted to group in Nov 08.
- **Document Distribution –** contractor websites available by Dec 08

Field Activities Conducted- 2008

- Removal of contaminated soils and site restoration of the Ash Landfill Dump Area at the Site 09.
- Site Inspection Activities for the Munitions Site 12 EOD Area, Munitions Bunker West, and Quarry Areas.
- Pore Water Sampling Program in the Eastern Plume Area.
- Area North of Site 02 Field Investigation.
- Pre-Design Sampling Program at the Navy Exchange Service Station
- XRF pilot study conducted by the USEPA for the former Bore Sight Range.
- Groundwater Assessment for 1,4 Dioxane evaluation in the Eastern Plume initiated.
- Installation of permanent monitoring wells at Site 09.
- Groundwater/Soil Assessment for petroleum residuals at the Old Navy Fuel farm.
- Direct push soil investigations in areas north and south of Site 09.
- Pump test at Extraction Well 5-B in the Eastern Plume.
- Soil and ground water investigations at Site 17-Former Pesticide Shop.
- Soil Investigation Program for Site 07.
- Preliminary sediment/surface water investigation at AOC Picnic Pond.
- Various Long Term Monitoring Activities throughout NAS Brunswick.

Projected 2009 Fieldwork

- Installation of permanent monitoring wells to assess 1,4 dioxane in the Eastern plume.
- Collection of water, sediment, and soil samples to assess background conditions.
- Cleanup of soils at the Navy Exchange Service Station.
- Installation of EW-5B Force Main to GWETS (if Required based on 1,4 Dioxane Pump Test Results).
- Various Long Term Monitoring Activities throughout NAS Brunswick.
- Small Point Lead Paint Investigation and Abatement (if required).
- Sabino Hill Rake Station Tower Demolition and Soil Removal.
- Collection of analytical chemical data for several munitions areas of concern.

Projected 2009 Non Fieldwork Items

- Finalization Munitions Constituents Work Plan.
- Finalization Background Work Plan.
- Development and Finalization of NEX Cleanup Work Plan.
- Development and Finalization of Site 17 Remedial Investigation Report.
- Development/Finalization of Site 17 Focused Feasibility Study Report.
- Public Meeting for Site 17 PRAP.
- Development and Finalization of Site 17 Proposed Remedial Action Plan (PRAP) and Record of Decision (ROD).
- Update of Administrative Record to Support Site 17 ROD.
- Development of Picnic Pond Summary Report.
- Development of Old Navy Fuel Farm Fall Sampling Data Report.
- Development and Finalization of Site 02 Investigation Report.
- Development of Interim Data Report for 1,4 Dioxane Fall Sampling and New Bedrock wells.

Projected 2009 Non Fieldwork Items (con't)

- Development of Site 09 Direct Push Ash Delineation Report.
- Development/Finalization of EW-5B Pump Test Report.
- Initiation of Navy "*Tiger Team*" Evaluation for GWETS, Eastern Plume and 1,4 Dioxane.
- Continue Development of Eastern Plume Groundwater Model.
- Assessment of Further Investigation/Clean-up at East Brunswick Transmitter Site.
- Assessment and/or Further Investigation/Clean-up at Topsham Annex (if required).
- NAS Brunswick Environmental Restoration Newsletters.
- Administrative Record Update.
- Assessment of Environmental Condition of Property/BETS.

2009 "Wish List"

- Site 07 Removal Action (if required).

  Note: also requires Action Memorandum or ESD (Explanation of Significant Difference).
- Site 17 Cleanup.
- Site 09 Cleanup Completion.
- Quarry Site Munitions Clearance (???)

BRAC Evironmental Tracking System (BETS) Overview

- 2007 CERFA "Clean" and Environmental Condition of Property (ECP) Reports – comprehensive documents that compiled existing information to support the "Findings of Suitability" that Navy must make in order to lease or transfer property under BRAC.
- Combined, the reports included the CERCLA and petroleum sites and the rest of the base.
- Some issues identified in these reports will require follow up such as further research, additional interviews, site walks, and sampling.
- As NAS Brunswick progresses through base closure and operational shut down, more issues will be identified, which will require resolution.
- Navy has developed a Web-based tool to track and document resolution of issues.

BRAC Evironmental Tracking System (BETS) Overview

- BETS – the system formerly known as ITS. Navy tool to ensure no issues " slip through the cracks".

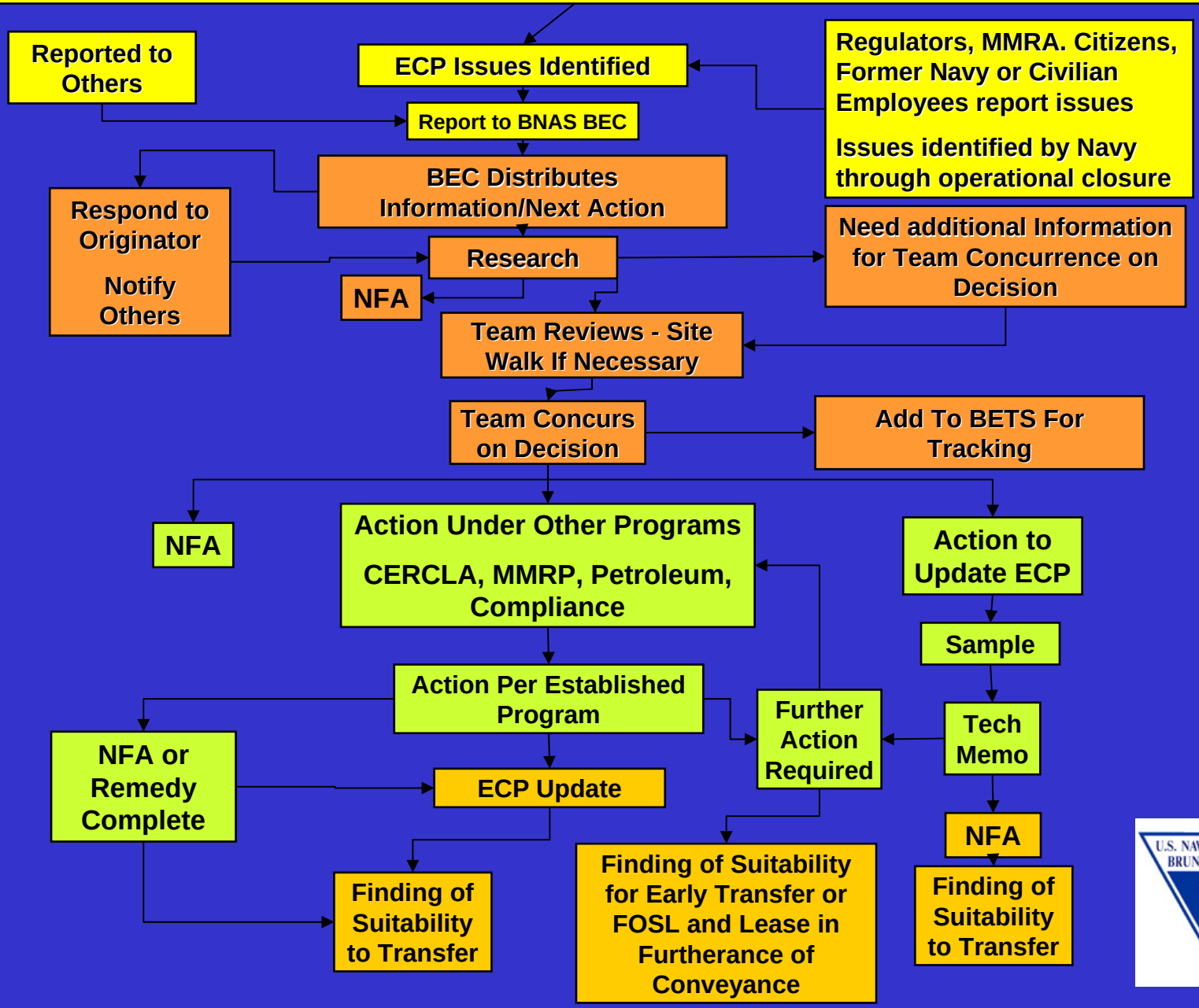
- Tracks and documents the life of Environmental Conditionas Property (ECP) follow-up issues and newly identified issues from identification through research, discussion, field activities, and decisions to No Further Action or action under another program.

- Geographical Information System (GIS) component associates each issue with a given location or area which will provide environmental due diligence information when parcels are identified for transfer.

BRAC Evironmental Tracking System (BETS) Overview

- BETS Application developed and is being modified.
- Demonstration for Stakeholders planned (2009).
- Part of overall process to ensure environmental issues that could affect suitability to lease or transfer property are identified and addressed.

ENVIRONMENTAL CONDITION OF PROPERTY UPDATE PROCESS



BRAC Off-Site Locations

- Small Point
- Sabino Hill
- East Brunswick
- Topsham Annex
- McKeen Street Housing

Small Point

- Sampling scheduled for Dec 08 – lead in soil
- Cleanup (if necessary) – Spring 09
- FOST – Spring/Summer 09
- Transfer back to owner – Summer 09

Small Point Rake Station
View from Access Road

U.S. NAVAL AIR STATION
BRUNSWICK MAINE

Sabino Hill

- Tower with flaking lead based paint.
- Tower Demolition and Soil removal.
- Covered by base-wide Environmental Impact Statement (EIS).
- Plan- transfer once EIS is completed (Spring 2010).

Sabino Tower

U.S. NAVAL AIR STATION
BRUNSWICK MAINE

East Brunswick

- Several potential areas of concern.
- Covered by base-wide EIS.
- Plan – transfer once EIS is completed (Spring 2010).

Topsham Annex

- Several potential areas of concern.
- Environmental Assessment (EA) –completed Spring 09.
- Goal – transfer by 2011, or sooner.

McKeen Street Housing

- Preliminary discussions.
- Covered by base-wide EIS.
- Goal –transfer by 2011, or sooner.

Emerging Contaminants

On September 21st, the Environmental Council of States passed a resolution endorsing the white papers from the EC work group. Note the recommendations on page 7, in particular No.1.

1. ***Based on the site history and site inspection, determine whether there is a real or suspected release of an EC that would trigger a need for sampling at a site and whether there is an appropriate analytical method.***

Summary: (Paul Yarochak)

To repeat what I said before, we don't sample at a specific site based on a general list (e.g., watch/action list). We sample based on *evidence* that a specific chemical may have been released.

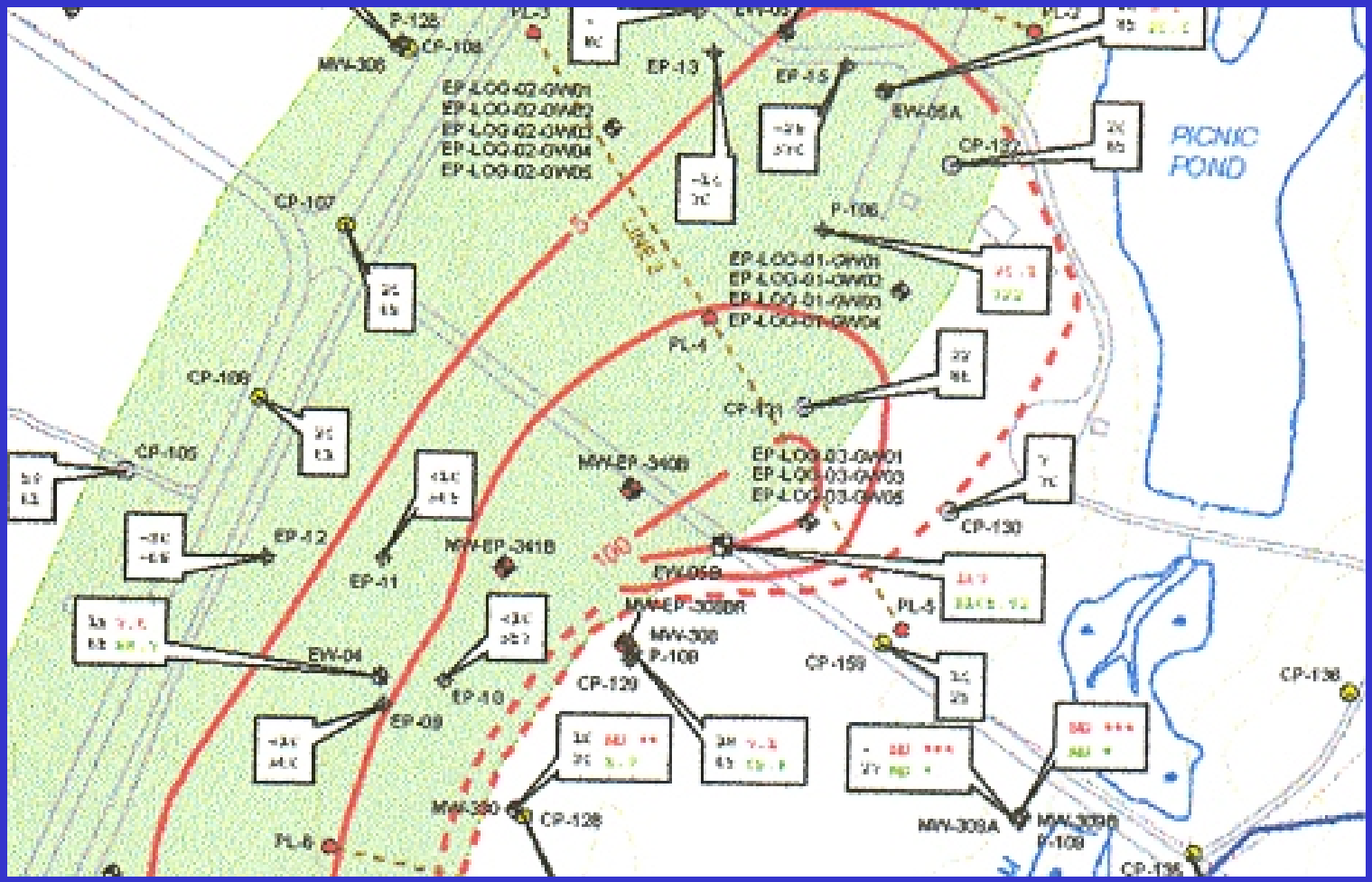
This is consistent with the language in CERCLA itself.

U.S. NAVAL AIR STATION BRUNSWICK MAINE

Bedrock Investigation: Objectives

- Determine if bedrock groundwater is contaminated in the vicinity of MW-308.
- Determine if contaminant concentrations in bedrock are from the overburden immediately upgradient of MW-308.
- Determine if Site 11 is a source of contamination to MW-308.
- Determine if the bedrock aquifer in the vicinity of MW-308 is hydraulically connected to private water-supply wells east of Merriconeag Stream.

Bedrock Investigation Well Locations



Bedrock Investigation Status/Update

Action	Status Update
• Complete 3 overburden boreholes/monitoring wells at 3 bedrock borehole locations	Nov. 08
• Core bedrock at 1 bedrock location	Nov. 08
• Install 3 open-hole bedrock wells	Nov. 08
• Bedrock borehole geophysical survey	Nov. 08
• Complete nested bedrock wells	Nov. 08
• Develop new overburden/bedrock monitoring wells	Dec.08
• Groundwater Sample/Water Level Gauging	Jun. 09
• Hydraulic Conductivity Testing	Jun. 09
• Data Evaluation/Validation	Jul. 09
• Draft Report Submission	Sept. 09

Bedrock Investigation Status/Update

COMPLETED ACTIVITIES:

- ***Oct. 2008-*** **Completed soil borings, and construction of 3 overburden monitoring wells.**

- **Oct. 2008 – Completed rock coring at MW-EP-342S location (near MW-308).**

- ***Nov. 2008-*** **Completed 3 bedrock boreholes; conducted borehole geophysical logging; and completed two nested bedrock wells in each borehole.**

Bedrock Investigation – Status/Update

UPCOMING ACTIVITIES

- Develop 3 Overburden and 6 bedrock wells
- Well elevation/location survey
- Measure groundwater levels
- Prepare groundwater contour maps and cross sections.
- Collect groundwater samples
- Perform in-situ hydraulic conductivity testing
- Evaluate/validate laboratory data.
- Prepare a draft report summarizing results of activities and provide recommendations for future activities, as necessary.

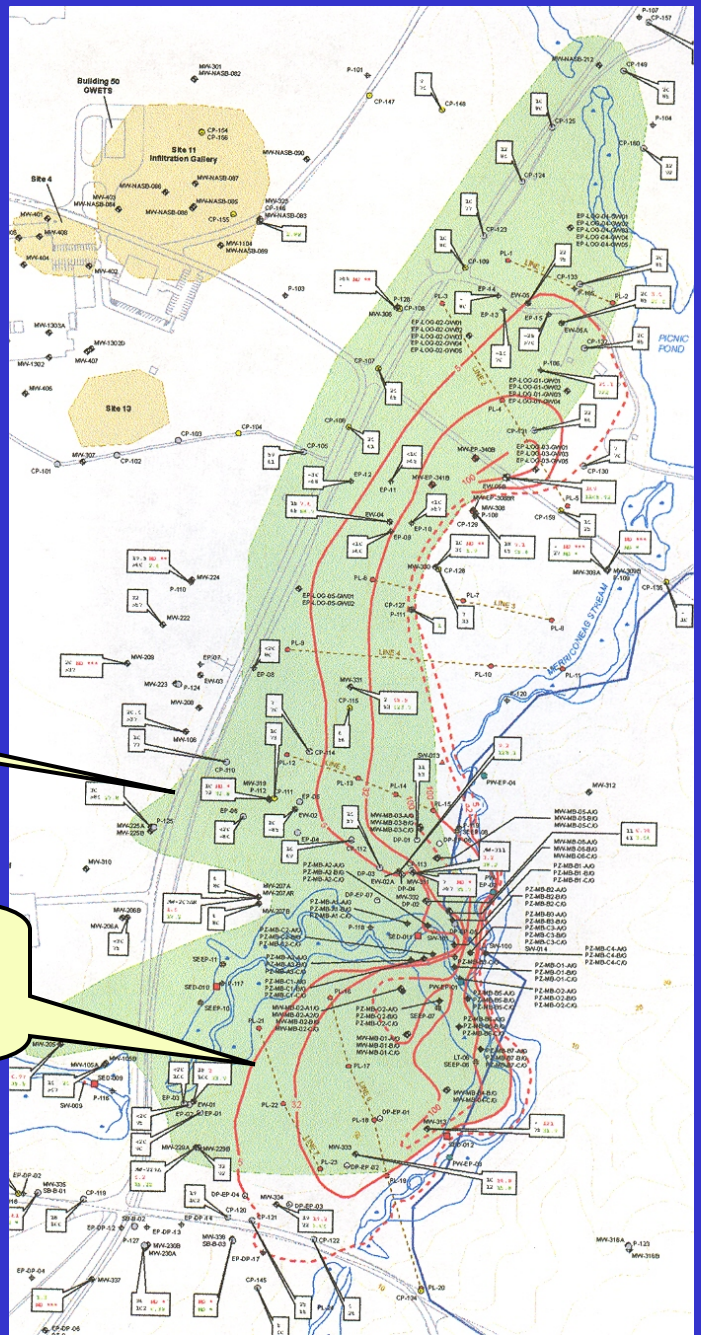
Bedrock Investigation - MW-308 Recent Groundwater Quality Results

ECC Fall 2008:

- *1,1-DCA - 3.4 ug/L (MEG - 70 ug/L)*
- *1,1-DCE - 7.4 ug/L (MEG – 0.6 ug/L)*
- *TCE - 14.4 ug/L (MEG – 7 ug/L)*
- *1,4-Dioxane - 10.8 ug/L*

Reference: Maine Exposure Guidelines (MEGs) for drinking water, Department of Human Services, July 28, 2008.

Eastern Plume Investigation – 1,4 Dioxane



1,4-Dioxane Investigation: Objectives

- Determine the extent 1,4-dioxane groundwater contamination.
- Determined if the conceptual site model has been adequately refined to understand significant groundwater and 1,4-dioxane flowpaths (current and future) and migration rates.
- Determine if the extent of chlorinated VOCs are adequately characterized within the 1,4-dioxane plume to support remedial decisions.

1,4-Dioxane Investigation Eastern Plume Status/Update

Action	Status Update
• Porewater Sampling	Aug. 08
• SAP for Groundwater Investigation	Oct. 08
• Direct Push/Electrical Conductivity	Nov.-Dec. 08
• Discrete groundwater sampling	Nov.-Dec. 08
• Bedrock Groundwater Investigation	Nov. 08
• Well Survey	Dec. 08
• Monitoring Well Installation	May. 09
• Groundwater Sample/Water Level Gauging	Jun. 09
• Hydraulic Conductivity Testing	Jun. 09
• Data Evaluation/Validation	Jul. 09
• Draft Report Submission	Sept. 09

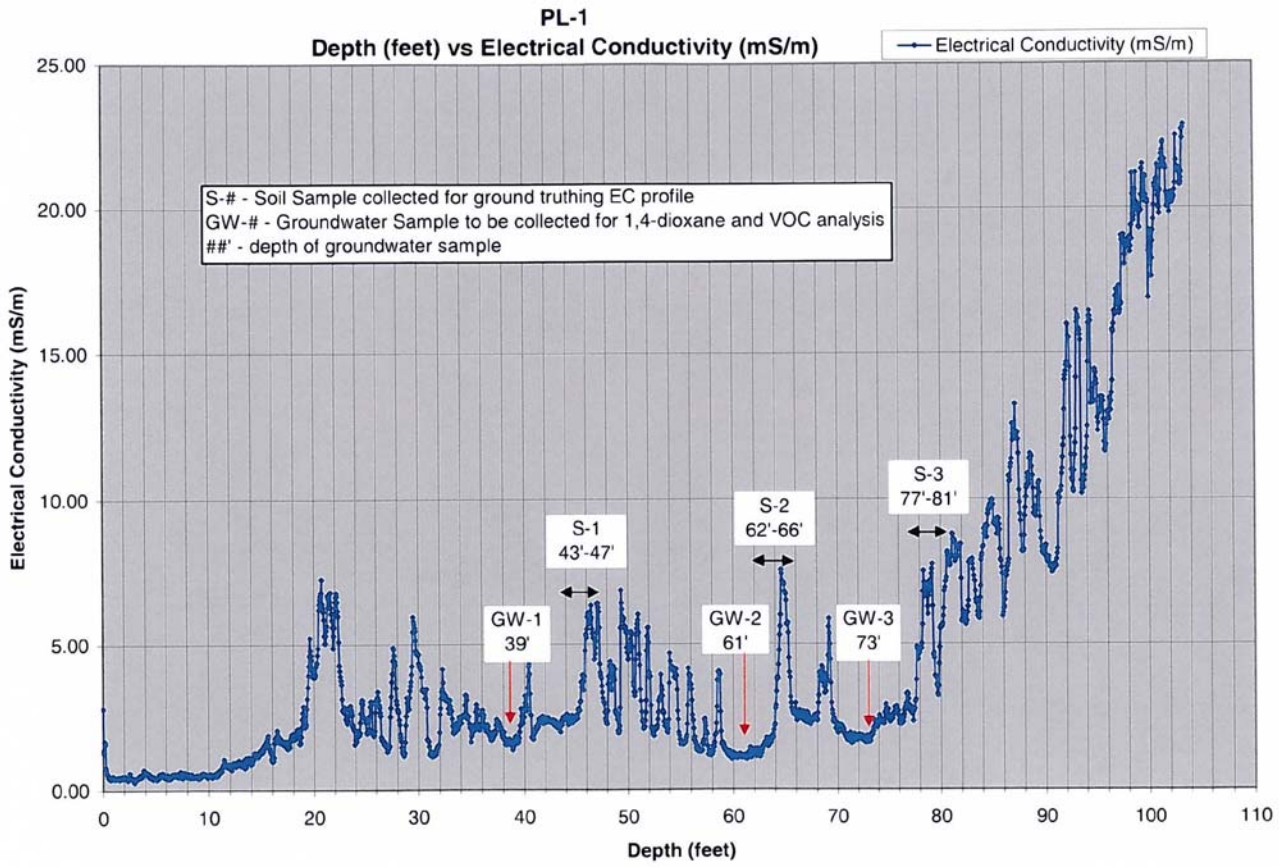
1,4-Dioxane Investigation Eastern Plume Status/Update

COMPLETED ACTIVITIES:

- **Sept. 2008 – Completed porewater sampling.**
- **Oct. 2008 – Completed analysis/evaluation of porewater results.**
- **Oct. 2008 – Finalized Sampling and Analysis Plan.**
- **Oct. 2008 - Dec. 2008 - Conducted electrical conductivity profiling and collected groundwater samples from temporary well locations.**

Direct-Push Electrical Conductivity Profiling Eastern Plume

Direct-Push Electrical Conductivity Profiling Eastern Plume



1,4-Dioxane Investigation in the Eastern Plume - Status

UPCOMING ACTIVITIES

- Install up to 25 new monitoring wells.
- Collect water level measurements and stream gauging measurements in Merriconeag Stream.
- Collect groundwater samples from newly installed and 9 existing monitoring wells.
- Conduct hydraulic conductivity testing in new monitoring wells.
- Survey soil boring and monitoring well locations and elevations.
- Evaluate/validate laboratory data.
- Prepare a draft report summarizing results of activities and provide recommendations for future activities, as necessary.

Site 17 Remedial Investigation

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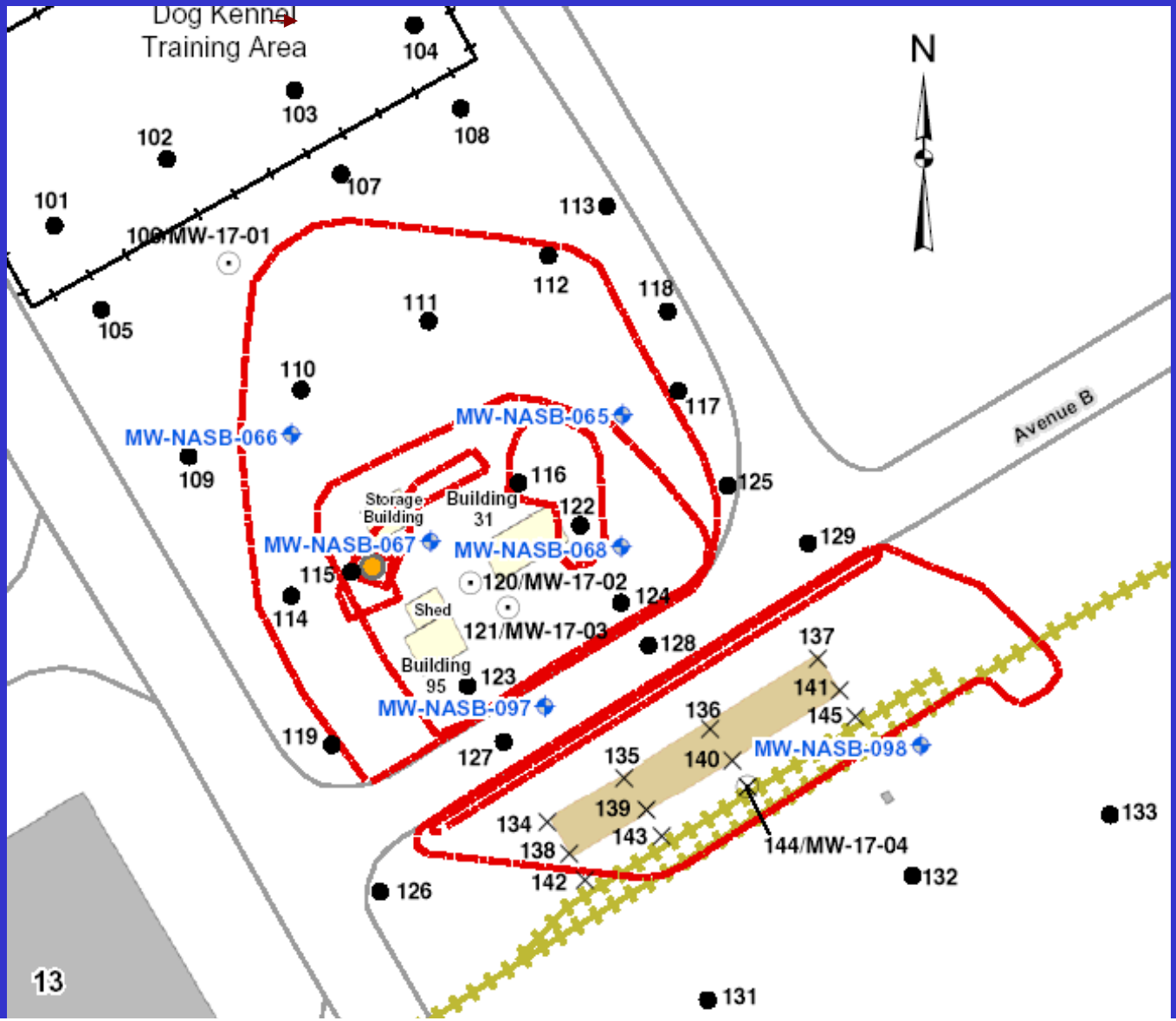
Site 17 Remedial Investigation: Objectives

- Evaluate the extent of soil and groundwater contamination.
- Evaluate if there is unacceptable current or future risk to human and ecological receptors.

Site 17 Remedial Investigation Status/Update

Action	Status/Schedule
• RI Phase I Fieldwork	Oct. 2008
• RI Phase I Data Analysis/Validation	Nov. 2008
• Phase II RI Field Work	Dec. 2008
• Boring/Monitoring Well Survey	Dec. 2008
• Phase II RI Data Analysis/Validation	Jan. 2009
• Site 17 Draft RI Report Submission	Apr. 2009
• Site 17 Focused Feasibility Study	Summer 2009

Site 17 Soil Boring/Monitoring Well Locations



Site 17 Remedial Investigation Status Update

COMPLETED ACTIVITIES:

- ***Jan. 2008-*** **Developed a Sampling and Analysis Plan for soil and groundwater investigations.**
- ***Oct. 2008-*** **Collected soil samples for analysis from soil borings in 45 locations across the former pest control operation area.**
- ***Oct. 2008-*** **Submitted 72 soil samples for analysis for pesticides, herbicides, metals, cyanide and diesel range organics from the soil borings to define the extent of impact.**
- ***Oct. 2008-*** **Installed 4 temporary monitoring wells to assess the extent of impacts from the former pest operations.**
- ***Oct. 2008-*** **Developed 4 newly installed and 5 existing monitoring wells in preparation for Phase II Investigation.**

Site 17 Remedial Investigation Status Update

INITIAL FINDINGS:

- A 1-1.5 foot thick black layer approximately 4 to 6 feet below grade in several borings located on the northern, southern side and in Avenue B as well as adjacent to the back of the operational buildings.

- Flame Ionization Detector screening measurements of the black layer yielded total VOC readings up to several thousand parts per million (ppm).

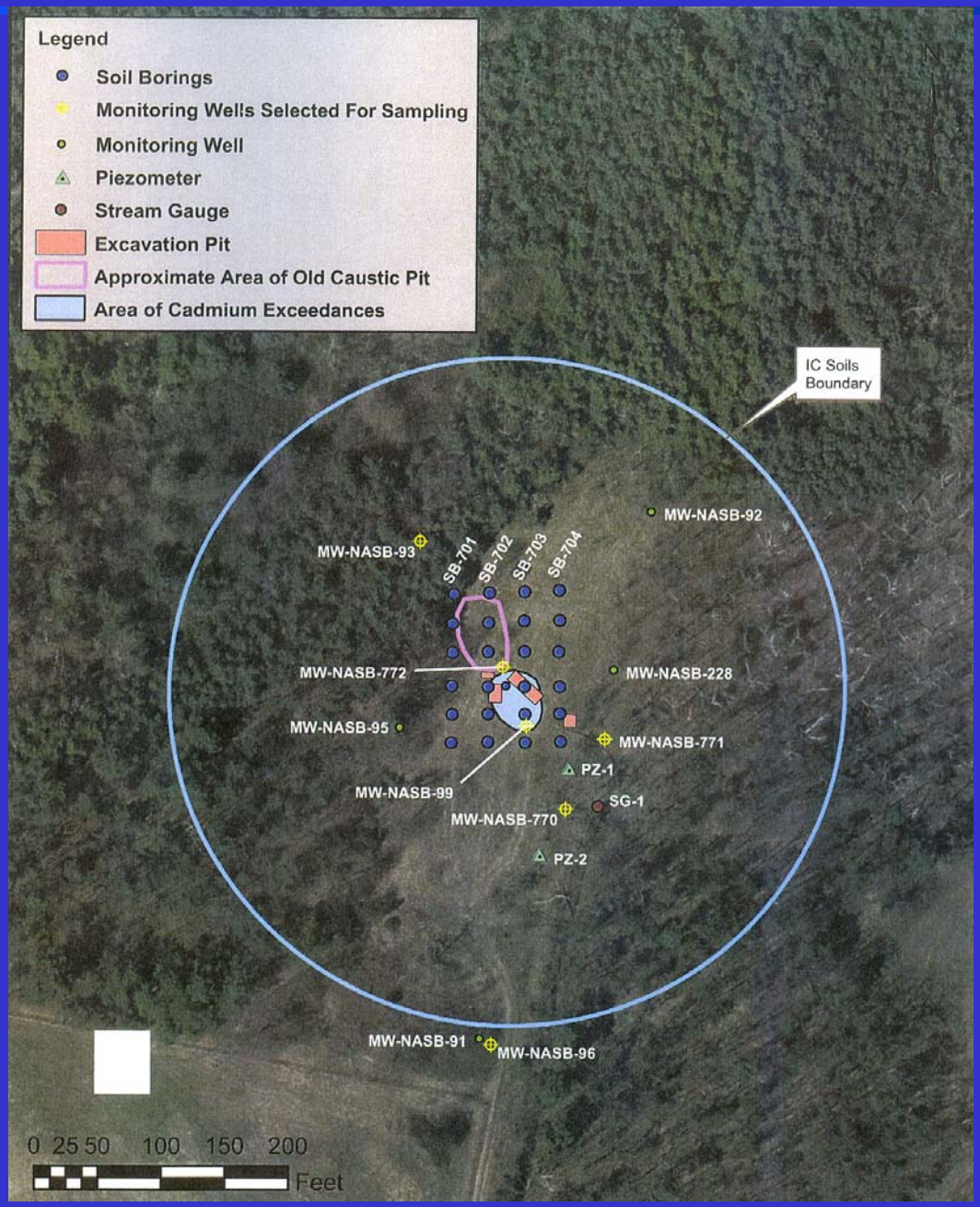
- Geotextile material was encountered in one boring (SB-17-141) at a depth of approximately 1 to 2 feet below grade.

Site 17 Remedial Investigation Status Update

UPCOMING ACTIVITIES

- Evaluate soil data collected during Phase I.
- Assess need for additional monitoring wells or soil borings to fill data gaps, if necessary (Phase II).
- Install new soil borings and/or monitoring wells, if necessary (Phase II).
- Collect groundwater samples from new and existing monitoring wells.
- Survey soil boring and monitoring well locations and elevations.
- Validate/evaluate laboratory data.
- Prepare a Draft Remedial Investigation (RI) report.
- Prepare draft Focused Feasibility Study to evaluate cleanup options.

Site 07 Sampling Locations



Site 07 Investigation: Objectives

- Determine the source of elevated metals concentrations in groundwater.

- Collect additional PCB, pesticides, PAH and metals data to better characterize the site because of a lack of sufficient data for site characterization.

Site 07 Status Update

Action	Status/Schedule
• Draft Sampling Plan	Nov. 2008
• Soil Borings	Dec. 2008
• Groundwater Sampling	Dec. 2008
• Surveyor Mapping	Jan. 2009
• Data Review/Validation	Feb. 2009
• Report Submission	Mar. 2009

Site 02 Inactive Landfill -Area North Investigation

Site 02 Investigation: Objectives

- Confirm presence (or absence) of potential contaminant source areas north and northwest of the Site 2 boundary.
- Evaluate groundwater flow and potential contaminant migration pathway to leachate seeps.

Site 02 Status Update

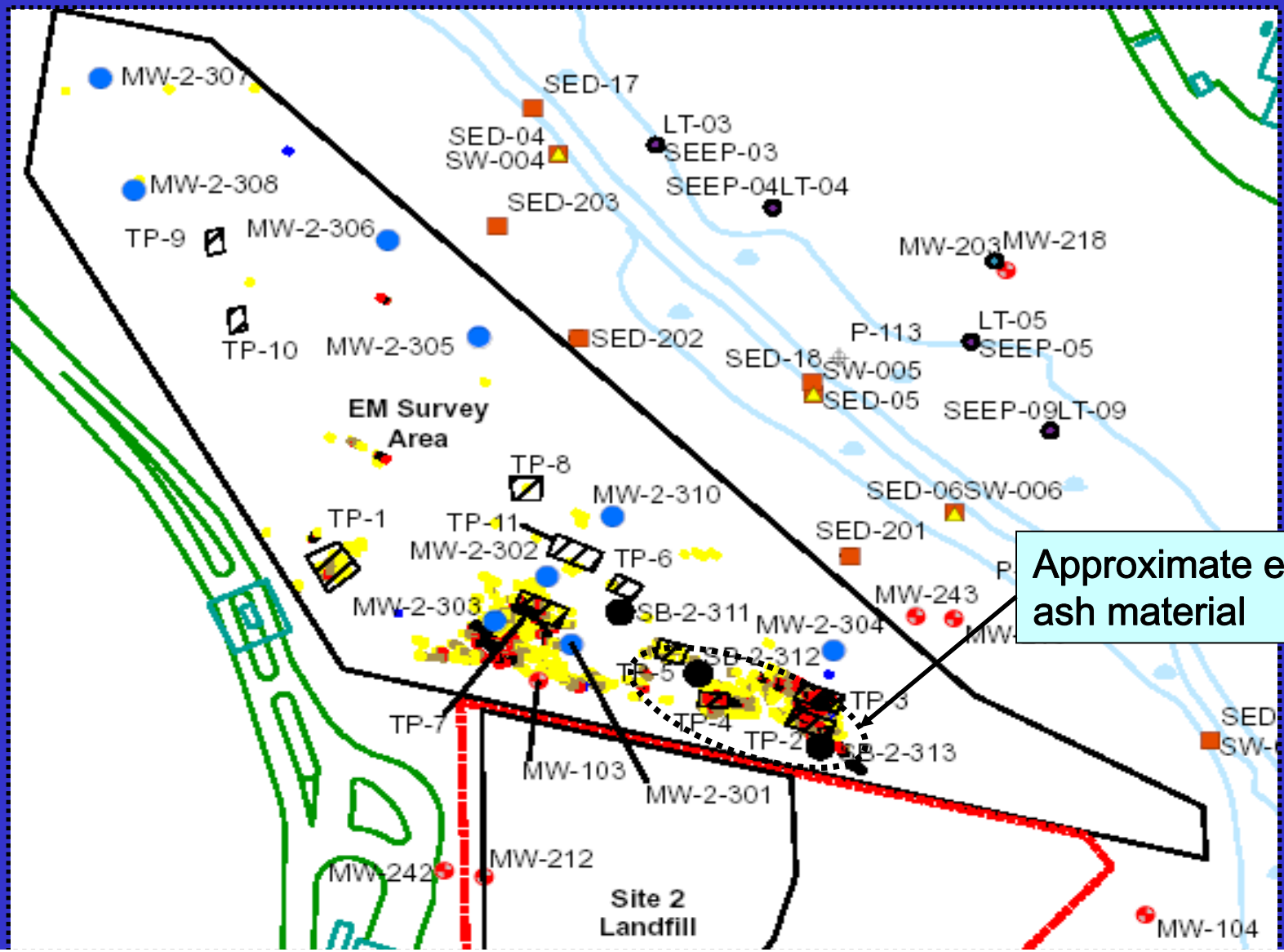
Action	Status/Schedule
• Test Pit Excavations	Completed
• Geophysical Surveys	Completed
• Soil Borings	Completed
• Well Installations	Completed
• Groundwater Sampling	Completed
• Surveyor Mapping	Dec. 2008
• Data Review/Validation	Jan. 2009
• Report Submission	Feb. 2009

Site 02 Investigation Status

COMPLETED ACTIVITIES:

- **Conducted geophysical surveys to define the locations of buried metal objects.**
- **Excavated 11 test pits and collected 15 soil samples for analysis for VOCs, SVOCs, pesticides/PCBs and TAL metals.**
- **Test pits located to target geophysical anomalies and to define extent of ash-like material.**
- **Advanced 12 soil borings and submitted soil samples for analysis for VOCs, SVOCs, pesticides/PCBs and TAL metals.**
- **Installed 10 monitoring wells.**
- **Developed/sampled new monitoring wells for VOCs, SVOCs, pesticides/PCBs and TAL metals.**

Site 02 - Area North - Geophysical Survey Results



Site 02 – Test Pit Excavation

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Site 02 Investigation: Initial Findings

- **Located former incinerator foundation.**
- **Test pits confirmed anomalies consist of metal and fill contains demolition debris.**
- **Ash found in vicinity of Site 2 landfill.**

Site 02 Investigation Status

UPCOMING ACTIVITIES:

- **Compile geophysical data to provide information on subsurface materials.**
- **Survey test pit, soil boring and monitoring well locations/elevations.**
- **Validate/evaluate soil data and groundwater monitoring data.**
- **Assess need for additional monitoring wells or soil borings to fill data gaps.**
- **Install additional soil borings and/or monitoring wells, if necessary.**
- **Report preparation/Submission: summarizing results of activities and provide recommendations for future activities, as necessary.**

MRP Sites
Discussion of Sample Compositing Methodology for Applicability to NAS Brunswick Munitions Constituents (MC) Site Inspection (SI)

December 3, 2008

Background

- Draft SI MC Work Plan submitted February 2008
- MEDEP review requested Multi Increment Sampling (MIS) as defined in SW-846 8330B includes:
  - compositing technique with 30 to 100 multiple increments per surface soil sample
  - sample preparation procedure (includes grinding) and
  - the analytical method

(Note that Navy chemists distinguish between MIS as the compositing technique only)

Key Elements of MIS Conceptual Site Model (CSM)

- Contaminants: Explosives & Propellants
- Contamination Depth: < 10 cm (4 inches) at surface
- Deposition Pattern: Heterogeneous distribution of particles (small chunks)
- Deposition Age: Relatively recent and nondisturbed so that contamination would be at the surface
- Decision-making: Establishment of mean (average) concentration per decision unit is acceptable for risk assessment purposes
- Sample preparation: Particle size reduction (grinding) is acceptable for comparison to criteria

Assessment of Non-MEC Sites

For the small arms sites (Skeet Ranges and Machine Gun Boresight Range):

- Method not applicable since explosives are not contaminants of concern
- XRF planned at each of these sites provides additional data

Assessment of MEC Sites - Quarry

For the Quarry:

- Method not applicable since the site has been disturbed and contamination, if any, is expected to be subsurface
- Other non-MC contaminants are of concern too based on debris/dumping at site

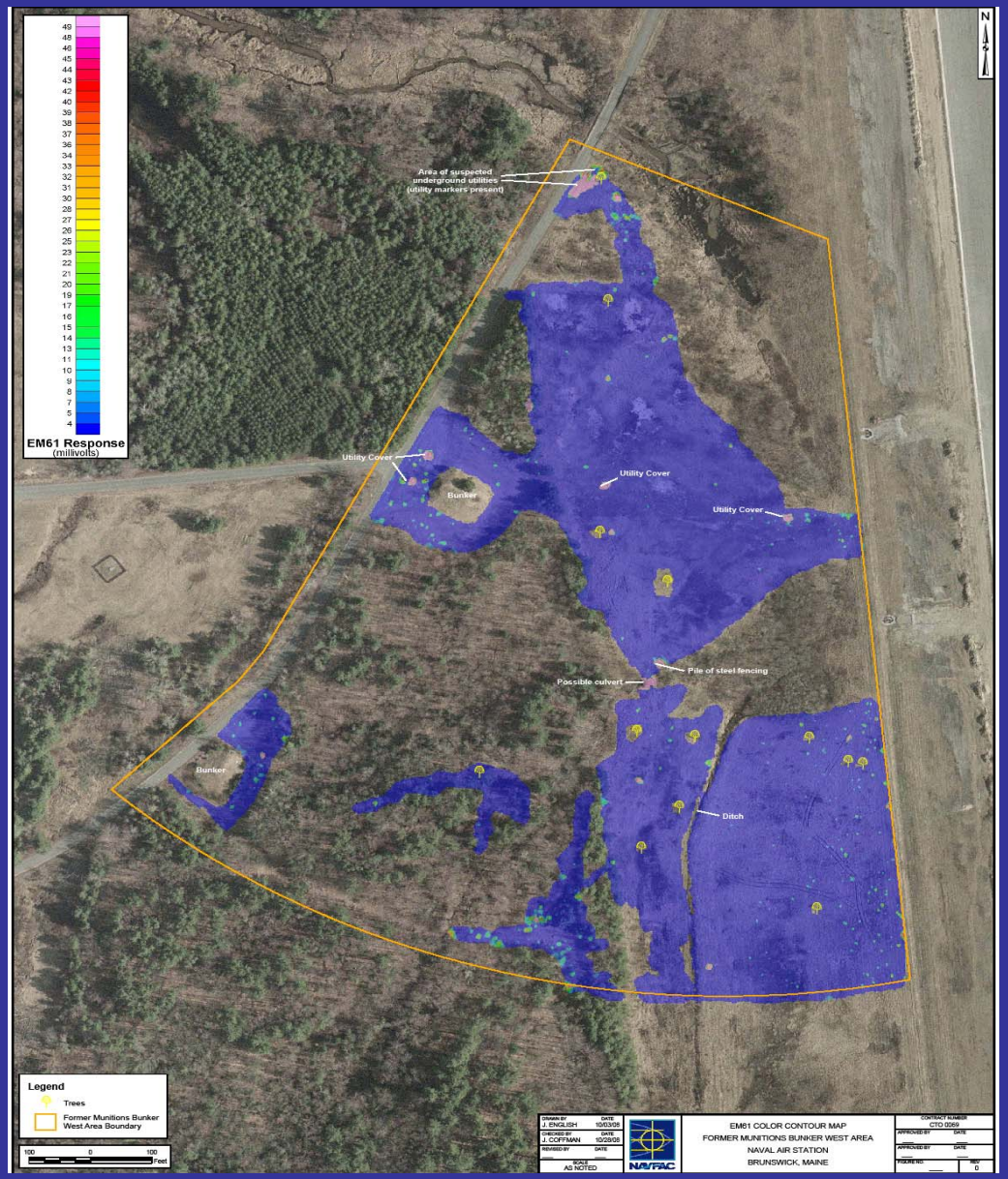
Assessment of MEC Sites – Former Munitions Bunker West

Method may be applicable since explosives are contaminants of concern, the site has not been disturbed, and surface soils are of concern, although no real “decision units” like firing point and target area

Considerations if MIS used:

- Mean concentration acceptable for decision making
- Surface soils at 0 to 4 inches acceptable for decision making
- Focus on explosives/propellants and not metals or other constituents
- For MEC investigation, numerous low-intensity anomalies were encountered that may or may not be MEC.
- No real decision units. Maybe collect one sample per grid area.
- Timing of MC sampling before or after MEC clearance effort
- New lab procurement and rewrite of Work Plan

FORMER MUNITIONS BUNKER WEST GEOPHYSICAL SURVEY RESULTS



Assessment of MEC Sites – Site 12 EOD Area

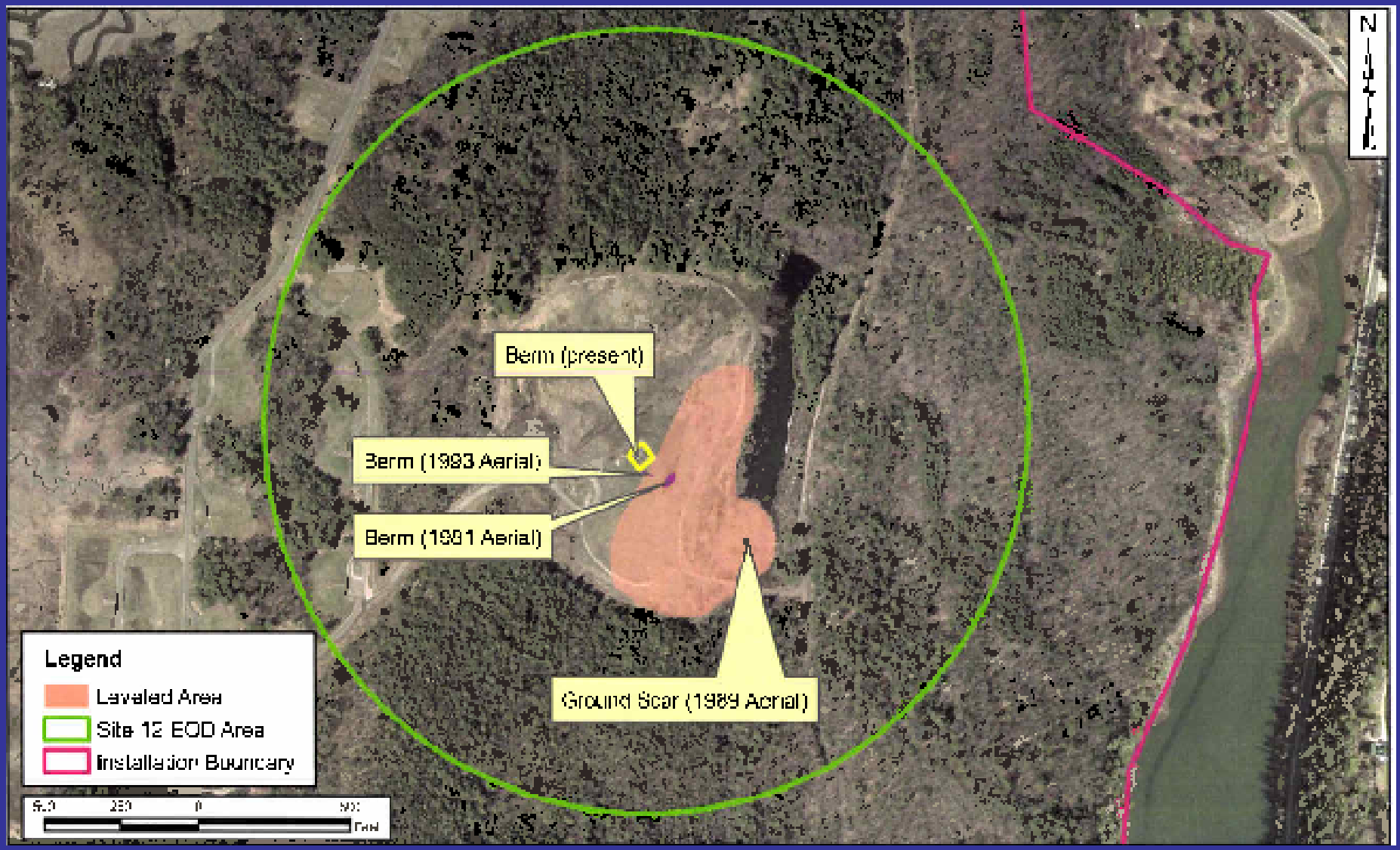
For the Site 12 EOD Area:

- Method is applicable since explosives are contaminants of concern and surface soils are of concern

Considerations if MIS used:

- Mean concentration acceptable for decision making
- Surface soils at 0 to 4 inches acceptable for decision making
- Focus on explosives/propellants and not metals or other constituents
- Timing of MC sampling before or after MEC clearance effort. If after MEC clearance effort, site has been disturbed and method not applicable. Collection of groundwater samples may aid in determining whether to conduct MC sampling before or after MEC clearance
- Decision units would focus on existing/historical bermed areas with high density of MEC anomalies and outer area with low density.
- New lab procurement and rewrite of Work Plan

Site 12 EOD Area – Site Layout



Background Study

Purpose:

- To determine naturally occurring and anthropogenic concentrations of selected chemical groups:
  - For surface soil and sediment - metals, polycyclic aromatic hydrocarbons (PAHs), and pesticides
  - For subsurface soil, surface water, seeps, and groundwater – metals and PAHs

Background Study

Purpose (continued)

- Background concentrations are compared to site investigation data to determine whether detected constituents are site-related.
- Statistical methods will be used to compare background datasets against site data.

Background Study

Technical Approach

- Seven on-base background areas have been identified as candidate areas for sampling.
- Site walks will be performed to ground-truth the areas as being appropriate for background sampling, locate seeps.

Background Study

Technical Approach (continued)

- Background datasets:
  - Soils – 60 surface, 60 subsurface samples
    - Upper sand, transitional sand, clay, and till units
  - Groundwater – 15 overburden wells x 3 rounds, 4 bedrock wells x 4 rounds
  - Seeps – 5 locations x 3 rounds
  - Surface water/sediment – 8 locations x 2 rounds

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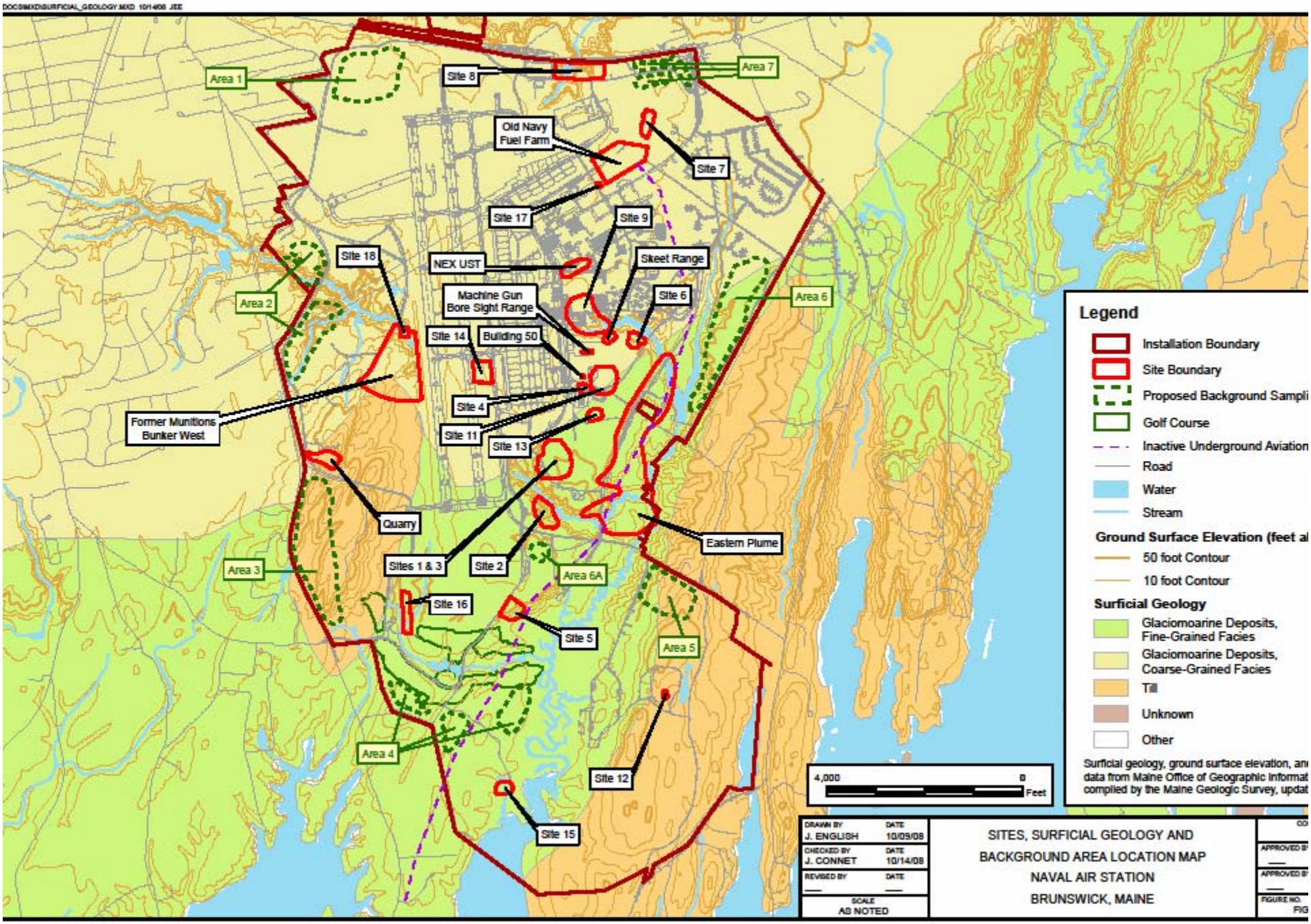
Background Study

Schedule

- Draft SAP sent out for review November 26, 2008
- Site walks December 2008
- Final SAP submission by February 2009
- Field sampling March – November 2009
- Interim Soils Report summer 2009
- Background Study Report January- April 2010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Site 8
Area 7
Old Navy Fuel Farm
Site 7
Site 17
Site 9
Site 18
NEX UST
Skeet Range
Area 2
Machine Gun Bore Sight Range
Site 6
Area 6
Site 14
Building 50
Former Munitions Bunker West
Site 4
Site 11
Site 13
Quarry
Eastern Plume
Area 3
Sites 1 & 3
Site 2
Area 6A
Site 16
Site 5
Area 5
Area 4
Site 12
Site 15
Legend
Installation Boundary
Site Boundary
Proposed Background Sampli
Golf Course
Inactive Underground Aviation
Road
Water
Stream
Ground Surface Elevation (feet al
50 foot Contour
10 foot Contour
Surficial Geology
Glaciomoarine Deposits, Fine-Grained Facies
Glaciomoarine Deposits, Coarse-Grained Facies
Till
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Other
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SITES, SURFICIAL GEOLOGY AND
BACKGROUND AREA LOCATION MAP
NAVAL AIR STATION
BRUNSWICK, MAINE
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ATTACHMENT C:
HANDOUTS

DRAFT FINAL

MERE BROOK FISH STUDY REPORT 2007:

Environmental Contaminants in Adult and Juvenile Eastern Brook Trout *(Salvelinus fontinalis)*

U.S. NAVAL AIR STATION
BRUNSWICK, MAINE

U.S. Environmental Protection Agency

New England Region I

Boston, Massachusetts

November 2008

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EXECUTIVE SUMMARY

Naval Air Station Brunswick (NASB) is located in the Town of Brunswick, Cumberland County, Maine. Mere Brook is a major drainage feature in the area which flows east of town more than 3 km to the NASB (the site). Eastern brook trout (*Salvelinus fontinalis*) were sampled and analyzed in 2007 and previously in 1995 (Mierzykowski et al. 1997) for the purpose of long-term monitoring in two Reaches: upstream (Reference Reach) and downstream (Site Study Reach) of the site runway that bisects the Brook which flows beneath through a 1 km long culvert. This report presents the fish tissue chemistry of the 2007 study, and because its methods of sampling and analysis are comparable to the 1995 study, a preliminary comparison is also made of the whole body tissue chemistry between these study years.

In the present study (2007), adult brook trout in both Reaches are found to have similar length-weight biometrics ("condition factor") however a wider range of condition factor is seen in the Reference Reach adult fish where they are more numerous (n=8) than in the Site Study Reach (n=3).

Adult and juvenile brook trout in either Reach have nearly the same lipid content in whole body tissue with the exception of juveniles in the Site Study Reach have about one-half the lipid content of the other brook trout in both Reaches. As a result, whole body concentrations of organochlorine pesticides in 2007 and 1995 are "normalized" to the lipid content in each specific sample to ensure the accuracy of the comparisons within and between Reaches and years.

Statistical tests of significance are not performed of the data because too few samples exist to meet the necessary test requirements however this report does include data summary tables and plots by life stage (adult or juvenile) and Reach for metals and pesticides. The 1995 data are also plotted along side the present study for preliminary comparison and discussion.

Data analysis of the tissue chemistry across Reaches indicates two major patterns are observed in 2007 and 1995: 1) higher or 2) lower average whole body concentrations in the Site Study Reach relative to upstream in the Reference Reach. In many cases there is no apparent pattern of higher or lower average concentrations between Reaches because the range of standard deviations is too great to distinguish a difference. This occurs more often in 2007 than 1995.

In 2007, higher average whole body concentrations of mercury and nickel are observed in juvenile brook trout in the Site Study Reach relative to Reference. The same observation is made in 1995 except in both life stages. Lower average whole body concentrations of lead, arsenic (juveniles) and strontium (adults) occur in Site Study Reach brook trout in 2007 relative to Reference. A higher average concentration of selenium is observed in juvenile brook trout in 1995 in the Site Study Reach but not in 2007.

In 2007, higher average whole body concentrations of 4-4'-DDT (adults) and 4-4'-DDE in brook trout are observed in the Site Study Reach relative to Reference. The same observation is made between Reaches in 1995 except that more pesticides are detected in both life stages of brook trout in 1995. Lower average whole body concentrations of methoxychlor and heptachlor epoxide are observed in juvenile brook trout in the Site Study Reach in 2007 relative to Reference.

Average whole body concentrations of arsenic, chromium, nickel, and vanadium are overall higher by a factor of two to six in brook trout in both Reaches in 2007 compared to 1995. On the other hand, average concentrations of strontium are lower by a factor of one-third in 2007 compared to 1995.

Average whole body concentrations of DDT and its metabolites are lower by a factor two to 10 fold in the Site Study Reach in 2007 compared to 1995. Total chlordane and dieldrin are lower by a factor of five to 10 in both Reaches in 2007 compared to 1995.

1.0 INTRODUCTION

Naval Air Station, Brunswick (NASB) is located in the Town of Brunswick, Cumberland County, Maine approximately 42 km northeast of the City of Portland, Maine (**Figure 1**). Mere Brook is a major drainage feature in the area which flows east of town more than 3 km past Route 123 and into a "Reference Reach" approximately 1.2 km in length upstream of the site. It then flows out of this Reach under the Base Perimeter Road and immediately into three 1 km long culverts beneath the NASB runways and emerges out the other side. After emerging, it flows into the "Site Study Reach" that is approximately 600 m long (**Figure 2**). The Brook is non-tidal in the study area and remains non-tidal for an undefined distance downstream where it becomes tidal.

2.0 STUDY OBJECTIVES AND HISTORY

In 1995, the U.S. Navy, U.S. Environmental Protection Agency (USEPA) and U.S. Fish and Wildlife Service (USFWS) sampled native, eastern brook trout *(Salvelinus fontinalis)* in Mere Brook at the NASB and the results were reported by Mierzykowski et al. (1997). The objective of the current study is to replicate the 1995 fish sampling and analysis and compare the current results to the 1995 data. The chemicals that were detected in whole body trout tissue in 1995 were metals (arsenic, cadmium, mercury, lead, chromium, copper, nickel, selenium, strontium, vanadium and zinc) and organochlorine pesticides (DDTs, chlordanes, dieldrin, methoxychlor, and heptachlor epoxide). Other pesticides and polychlorinated biphenyls (PCBs) were *not* detected in 1995 and so they were not tested in 2007.

2.1 Biological Characterization

Mere Brook is generally shallow at ≤1 m depth and 1 to 3 m width with bordering wetland. The surrounding tree layer is similar throughout the Brook with white pine *(Pinus strobus)*, hemlock *(Tsuga Canadensis)*, red oak *(Quercus rubra)*, red maple *(Acer rubum)*, and bigtooth aspen *(Populus grandidentata)* (Mierzykowski et al. 1997). The herbaceous groundcover layer supports skunk cabbage *(Symplocarpus foetidus)*, mosses *(Sphagnum* spp.), grasses *(Gramineae)*, sedges *(Carex* spp.), goldenrod *(Solidago* spp.), broad-leaved cattail *(Typha latifolia)*, wool grass *(Scirpus cyerinus)*, nightshade *(Solanum dulcamara)*, and jewelweed *(Impatiens capensis)*.

In the Site Study Reach, the bottom of the Brook is embedded to a high degree with loose, medium to coarse sand and there is little or no over story vegetation. There is considerable herbaceous vegetation along the banks which can overhang the Brook and approximately 50% of the riverbanks are undercut. The Reference Reach is similar except that there is considerable woody vegetation (shrubs and trees) overhanging the Brook and there is less embeddedness and more gravel on unconsolidated bottom. Therefore, the Reference Reach appears to qualitatively possess better brook trout habitat. Resident fish species in the Brook include eastern brook trout, American eel *(Anguilla rostrata)*, blacknose dace *(Rhinichthys atratulus)*, and stickleback (Gasterosteidae) (Mierzykowski et al. 1997) also seen in 2007.

A working assumption in the 2007 study is that eastern brook trout do not migrate up or downstream between Reaches through the runway culvert, and so the runway is thought to effectively separate the trout populations. Fish migrating between the Reaches would have to endure high water velocities and a long dark passage which they are unlikely to do (Belford and Gould 1989). In addition, a metal grate covers both ends of the culvert and in the upstream end there is a beaver dam and pond in 2007 and at the downstream end a clog of woody debris causing a ¼ m water fall that could further restrict fish migration through the culvert.

3.0 METHODS

Brook trout were collected in Mere Brook from the Reference Reach on July 9, 2007 and the Site Study Reach on July 10, 2007. Fishing was done using a backpack electro-fisher under scientific collection permit issued by the State of Maine and presented in the Quality Assurance Project

Plan (QAPP) (USEPA 2007). Appropriate disinfection and biosecurity protocols were followed per the QAPP while sampling.

Adult and juvenile fish were held in aerated holding tanks and released live once it was decided based on species, numbers and sizes which of the fish would be sampled for tissue chemistry. Fish for sampling were transported and kept live in a central processing area free of possible site contamination where they were sorted and length (± 0.5 cm) and weight (± 0.5 g) measurement taken. Juveniles were pooled into composite samples and the total weight of each composite was measured and recorded to the nearest half gram. The ratio of fish weight to length cubed was calculated on adult fish (n=12) to estimate condition factor (K) which is a growth biometric based on the premise that non-stressed or well-fed fish have a higher ratio (are in "better condition") than stressed or poorly-fed fish of the same length for the same species (USFWS 1982).

$$\text{Condition Factor: } K = \frac{W}{L^3}$$

where: K = condition factor
W = weight in grams
L = maximum total length in millimeters.

Each adult fish was examined for external lesions however notes were only recorded for three adult fish sampled in the Site Study Reach. Scales were removed from each adult or a subset of juveniles in a composite and placed dry into labeled coin envelopes for archive and possible future aging. Whole fish were wrapped in aluminum foil (dull side in), labeled, and placed into clean plastic gallon size freezer bags. Bags were then placed immediately onto a large block of dry ice within a dry-ice cooler and were stored at -20°C and transported frozen by to the lab.

Thirteen total composite samples (6 composite adult fish and 7 composite juvenile fish) were transported directly by lab courier to Alpha Wood Hole Laboratory (AWHL) in Mansfield, MA. Chemical analyses was performed by AWHL for mercury (method 7470A/7471A), metals (method 6020), organochlorine pesticides (method 8081A), percent lipid (EPA-600/4-81-055), and percent moisture was determined. The lab reported metals in units of mg/kg (ppm) wet weight (ww) and pesticides in ug/kg (ppb) ww, however this report converts pesticide concentrations to mg/kg ww.

In addition, the pesticide data was "lipid normalized" or adjusted on the basis of lipid content with units of mg/kg lipid (USEPA 1995). Lipid normalization was done because tissue lipids or fats are an organic phase or compartment in living fish that pesticide molecules partition into, driven by its chemical thermodynamics or tendency as a "hydrophobic" molecule to "escape" from the water into the organic phase (tissue lipid) to maintain the lowest possible free-energy state with its surrounding environment. Therefore, because tissue lipid can greatly influence the concentration of pesticide in the tissue, lipid normalization was done to improve the accuracy of comparing pesticide whole body concentrations between Reaches and years.

Quality assurance/quality control was achieved through use of an approved quality assurance project plan (USEPA 2007) and lab data packages underwent Tier II data validation procedures by the USEPA New England Regional Laboratory (NERL). The NERL identified minor data quality issues that were corrected by AWHL and the validated data was used to write this report.

One "duplicate" juvenile brook trout sample (BKT-J-REF-DUP) was collected in the Reference Reach with three composite juvenile brook trout samples (BKT-J-REF-1, -2 and -3). The three composites were collected July 9, 2007 and the duplicate on July 10, 2007. The duplicate was treated in this report as an independent (fourth) sample.

Tests for statistical significance were not performed on the data because of small sample sizes (n=3 or 4 samples). Instead, average whole body and standard deviation concentrations were plotted by Reach across years 1995 and 2007 for purpose of data visualization and pattern

comparisons. Two or three major patterns by Reach across years 1995 and 2007 were generally recognized and are discussed in the next section.

4.0 RESULTS AND DISCUSSION

4.1 Fish Biology

Length and weight data for adult brook trout are summarized in **Tables 1 and 2** and is seen as a linear relationship in **Figure 3.** During sample processing, adult brook trout from the Site Study Reach were each observed to have light infestations of 4-7 parasitic copepods (*Salmincola edwardsii*) along the leading edge of their dorsal fins and attached to their gill arches.

The plot of individual adult lengths v. weights in Figure 3 and condition factor in **Figure 4** suggest that trout from the Site Study Reach (n=3) had less variable condition factor relative to Reference Reach trout (n=8). Assuming brook trout in the Reaches were in fact separated by the culvert, the result indicates no significant difference in growth biometrics or condition between the Reaches.

4.2 Metals Tissue Chemistry

Summary

Figures 5, 6 and 7 summarize the average metal whole body concentrations bounded by standard deviation (SD) among juvenile (**a**) or adult (**b**) brook trout samples collected in 1995 or 2007 from Site Study or Reference Reaches. If there is no visible data bar in the figures then the metal was either not tested ("NA") or not detected ("ND"). If there is no "whisker" (±SD) on the data bar then there was one detect in one sample or identical concentrations were measured. **Tables 3 and 4** present metals data for individual composites for adults or juveniles, respectively.

Analysis of the metals tissue data are performed by visualizing the plotted data and spotting patterns by Reach across years 2007 and 1995 and is summarized in **Table 5**.

Table 5. Summary of metals with average whole body concentrations that are higher or lower in the Site Study Reach relative to the Reference Reach by study year.

STUDY YEAR	Site Study Reach Has Higher Avg. Whole Body Metals Concentrations	Site Study Reach Has Lower Avg. Whole Body Metals Concentrations	No Apparent Pattern of Higher or Lower Avg. Whole Body Metals Conc.
2007	Mercury - juveniles Nickel – juveniles	Lead Arsenic - juveniles Strontium – adults	Mercury – adults Nickel - adults Arsenic - adults Strontium - juveniles Cadmium Chromium Copper Selenium Vanadium Zinc
1995	Mercury Nickel Selenium - juveniles	Chromium – juveniles Zinc - juveniles	Selenium – adults Chromium - adults Zinc - adults Arsenic Cadmium Copper Lead Strontium Vanadium

The analysis identified two major patterns: higher or lower average whole body concentrations in the Site Study Reach trout relative to Reference trout.

Averages in the adults in both Reaches are overall higher in 2007 compared to 1995 for arsenic, chromium, nickel, and vanadium, but the average is lower in 2007 for strontium.

Higher Average Whole Body Concentrations in the Site Study Reach

Higher average whole body concentrations of mercury and nickel are seen in Site Study Reach brook trout in 2007 (juveniles only) and 1995 (both life stages) relative to Reference Reach trout.

Mercury: Average whole body concentrations of mercury in juvenile brook trout in 2007 are more than two-fold higher in the Site Study Reach relative to Reference (0.09 mg/kg compared to 0.04 mg/kg mercury), but adults that year are within the range of standard deviation. In 1995, average whole body mercury concentrations for both life stages are also considerably higher in the Site Study Reach (averages 0.06 mg/kg in juveniles or 0.12 mg/kg in adults) relative to Reference (averages 0.04 mg/kg in juveniles or 0.06 mg/kg in adults) (Mierzykowski et al. 1997).

Nickel: Average whole body concentrations of nickel in juvenile brook trout in 1995 and 2007 are considerably higher in the Site Study Reach (0.26 and 0.33 mg/kg respectively) relative to Reference (0.09 and 0.2 mg/kg respectively). In 1995 adults also have higher average whole body concentrations in the Site Study Reach (0.10 mg/kg) as they are non-detect in Reference. However in 2007, the Site Study Reach and Reference Reach adult brook trout are within the range of standard deviation measured in each.

Selenium: In 2007, average whole body concentrations of selenium in brook trout have no apparent pattern as the range of standard deviations makes them indistinguishable, although averages for the Site Study Reach are 0.56 (juveniles) and 0.70 (adults) mg/kg and Reference Reach are 0.55 (juveniles) and 0.63 (adults) mg/kg. However, in 1995 higher average whole body concentrations are distinguishable between only juveniles in the Site Study Reach (0.65 mg/kg) relative to Reference (0.61 mg/kg) because of a narrow range of standard deviations. There is no apparent pattern for adults in 1995 between Reaches because of a broad range of standard deviation in averages for Site Study (0.48 mg/kg) and Reference (0.57 mg/kg) Reaches.

Lower Average Whole Body Concentrations in the Site Study Reach

Lower average whole body concentrations of lead, arsenic, and strontium in 2007 are seen in juveniles, and chromium and zinc in 1995 in adults in the Site Study Reach relative to Reference.

Lead: Average whole body concentrations of lead in juvenile and adult brook trout in 2007 are up to two-fold higher in the Reference Reach compared to the Site Study Reach. Averages ranged from 0.08 mg/kg in juveniles and 0.11 mg/kg in adults in the Reference whereas the Site Study Reach has averages of 0.04 mg/kg in juveniles and 0.06 mg/kg in adults. One possible explanation for the elevated tissue lead in the Reference brook trout upstream is that two public roads cross the brook in this Reach but no such crossings occur in the Site Study Reach. In 1995, average concentrations in both life stages for both Reaches is within the range of standard deviation and so there is no apparent pattern seen in that year.

Arsenic: Average whole body concentrations of arsenic in juvenile brook trout in 2007 are lower in the Site Study Reach (0.05 and 0.07 mg/kg respectively) compared to Reference (0.06 and 0.08 mg/kg respectively). Because average concentrations in the adults are within the range of standard deviation, lower averages are only seen in juveniles in the Site Study Reach in 2007. In 1995, averages in both life stages are in the range of standard deviation for both Reaches and so no pattern is apparent.

Strontium: Average whole body concentrations of strontium in adults in 2007 are lower in the Site Study Reach (5.6 mg/kg) compared to Reference (9.4 mg/kg). Otherwise, in 2007 and 1995, average whole body concentrations are within the range of standard deviation between Reaches.

Chromium: In 1995, juvenile brook trout in the Site Study Reach have considerably lower average whole body concentration (0.18 mg/kg) relative to Reference (0.57 mg/kg). Whereas, the average whole body concentrations of chromium in adults in 1995 and both life stages in 2007 are within the range of standard deviation in each Reach.

Zinc: In 1995, juveniles in the Site Study Reach had distinguishably lower average whole body concentrations (25.52 mg/kg) than juveniles in the Reference Reach (27.65 mg/kg). However, average concentrations in 2007 in both life stages and 1995 in adults have no apparent pattern because the broad range of standard deviations make these averages indistinguishable.

No Apparent Pattern

Only cadmium, copper, and vanadium in both study years and both life stages have no apparent pattern of higher *or* lower average whole body concentrations. These tissue metals data are discussed below. Unique to 2007 and for both life stages, chromium, selenium, and zinc have no apparent pattern of higher *or* lower average whole body concentrations in the Site Study Reach relative to Reference. And unique to 1995 for both life stages, arsenic, lead, and strontium have no apparent pattern that can be distinguished.

Cadmium: In 2007, there is no apparent pattern in average whole body concentrations between Reaches because the values are within the range of standard deviation for both Reaches. During that year, the average whole body concentration in Site Study Reach trout is 0.04 mg/kg (juveniles) and 0.07 mg/kg (adults) and Reference trout is 0.03 mg/kg (juveniles) and 0.03 mg/kg (adults). In 1995, averages in juveniles are identical between Reaches (0.04 mg/kg) and slightly lower in adults (0.02 mg/kg) relative to Reference (0.03 mg/kg) but within the range of standard deviation. Therefore, in both years and for both life stages there is no apparent pattern of higher or lower average whole body concentrations.

Copper: Average whole body concentrations of copper in 2007 in the Site Study Reach are indistinguishable from the Reference Reach. Averages in the Site Study Reach are 1.06 mg/kg (juveniles) and 1.18 mg/kg (adults) and the Reference Reach are 0.98 mg/kg (juveniles) and 1.73 mg/kg (adults) but are within the range of standard deviations. The same conclusion is drawn from the 1995 data. Average whole body concentrations in the Site Study Reach are 1.44 mg/kg (juveniles) and 1.49 mg/kg (adults) and for Reference are 1.33 mg/kg (juveniles) and 2.14 mg/kg (adults) but within the range of standard deviations. Therefore, it is concluded that in both years for both life stages, there is no apparent pattern of higher or lower average concentration in trout.

Vanadium: There is no apparent pattern of higher or lower average whole body concentration in 2007 or 1995 for either Reach because the averages are within the range of standard deviations. Average whole body concentrations of vanadium in 2007 are higher in juveniles in the Site Study Reach (0.83 mg/kg) compared to Reference (0.39 mg/kg) but lower in adults respectively (0.93 mg/kg compared to 2.0 mg/kg).

4.3 Organochlorine Pesticide Tissue Chemistry

Summary

Figures 8 and 10 (not normalized for lipids) and **9 and 11** (lipid normalized) summarize the average whole body concentrations of organochlorine pesticides for juvenile (**a**) or adult (**b**) brook trout samples in 2007 and 1995 from the Reference and Site Study Reaches. The data are

bounded by ±SD data. **Tables 6, 7, 8 and 9** report all of the 2007 tissue sample data. The 1995 data can be found in Mierzykowski et al. (1997). Only the lipid normalized data are discussed.

Adult brook trout sampled across years and Reaches have nearly the same lipid content and also juvenile trout across years in the Reference Reach (7.3 to 7.7% lipid on average). However, juvenile brook trout in the Site Study Reach have more than one-half this percentage of lipid in the tissue (4.3% lipid on average). The finding supports the use of lipid normalized whole body pesticide data to ensure the accuracy of the comparisons across years and between Reaches. For this reason, the lipid normalized data alone are discussed in this report.

Analysis of the lipid normalized pesticide data are performed by visualizing the plotted data and spotting patterns by Reach across years 2007 and 1995. The results are summarized in **Table 10**. Two major patterns were observed: higher or lower average whole body concentrations in Site Study Reach brook trout relative to Reference Reach brook trout.

Table 10. Summary of pesticides with average whole body concentrations that are higher or lower in the Site Study Reach relative to the Reference Reach by study year.

STUDY YEAR	Site Study Reach Has Higher Avg. Whole Body Pesticide Concentrations	Site Study Reach Has Lower Avg. Whole Body Pesticide Concentrations	No Apparent Pattern of Higher or Lower Avg. Whole Body Pest. Conc.
2007	4-4'-DDE – juveniles 4-4'-DDT - adults	Methoxychlor – juveniles Heptachlor - juveniles	4-4'-DDE – adults 4-4'-DDT - juveniles Methoxychlor – adults Heptachlor - adults 4-4'-DDD total DDT trans-Chlordane cis-Chlordane total Chlordane Dieldrin
1995	4-4'-DDE 4-4'-DDT - adults total DDT - adults trans-Chlordane – adults cis-Chlordane total Chlordane Dieldrin		4-4'-DDT - juveniles total DDT - juveniles 4-4'-DDD trans-Chlordane - juveniles Methoxychlor Heptachlor

A comparison between years indicate there are lower average concentrations of DDT and its metabolites in brook trout by a factor two to 10 in both Reaches in 2007. In contrast, other pesticides are detected in 2007 but not in 1995. They include trans- and cis-chlordane, total chlordane, dieldrin, methoxychlor, and heptachlor epoxide in the Reference Reach; and methoxychlor and heptachlor epoxide in adult trout only in the Site Study Reach.

Higher Average Whole Body Concentrations in the Site Study Reach

DDT and its metabolites: In 2007, higher average whole body concentrations of 4,4'-DDE in juveniles (0.4823 mg/kg) and 4,4'-DDT in adults (0.0995 mg/kg) are measured in the Site Study Reach relative to Reference (0.3105 and 0.0315 mg/kg, respectively). Total DDT and its other metabolites are within the range of standard deviation between the Reaches and therefore present no apparent pattern. In 1995, 4-4'-DDE in both life stages and 4,4'-DDT and total DDT in adults are measured at higher average whole body concentrations in the Site Study Reach. It is significant to note that average whole body concentrations of these pesticides in 2007 are lower by a factor of two to 10 in both Reaches compared to 1995.

Chlordane and its metabolites: In 1995, higher average whole body concentrations of trans-chlordane in adults, and cis-chlordane and total chlordane in both life stages are seen in the Site Study Reach. However in 2007, there is no apparent pattern between Reaches because the average concentrations of these pesticides are within the range of standard deviation.

Dieldrin: In 1995, higher average whole body concentrations are seen in the Site Study Reach relative to Reference. However in 2007, there is no apparent pattern between Reaches because the average concentrations of these pesticides are within the range of standard deviation.

Lower Average Whole Body Concentrations in the Site Study Reach

Methoxychlor and Heptachlor Epoxide: In 2007, lower average whole body concentrations are seen in juvenile brook trout in the Site Study Reach (NDs) relative to Reference (0.0963 mg/kg methoxychlor and 0.0075 mg/kg heptachlor epoxide). However, adult brook trout in 2007 have no apparent pattern between Reaches because the averages are within the range of standard deviation. In 1995, these pesticides are not detected in either Reach or life stage.

5.0 SUMMARY AND CONCLUSIONS

Summary

The condition factor of adult brook trout in the Site Study and Reference Reaches are similar. Data analysis of the tissue chemistry across Reaches indicates two major patterns are observed in 2007 and 1995: 1) higher or 2) lower average whole body concentrations in the Site Study Reach relative to upstream in the Reference Reach. In many cases there is no apparent pattern of higher or lower average concentrations between Reaches because the range of standard deviations is too great to distinguish a difference. This occurs more often in 2007 than 1995.

In 2007, higher average whole body concentrations of mercury and nickel are observed in juvenile brook trout in the Site Study Reach relative to Reference. The same observation is made in 1995 except in both life stages. Lower average whole body concentrations of lead, arsenic (juveniles) and strontium (adults) occur in Site Study Reach brook trout in 2007 relative to Reference. A higher average concentration of selenium is observed in juvenile brook trout in 1995 in the Site Study Reach but not in 2007.

In 2007, higher average whole body concentrations of 4-4'-DDT (adults) and 4-4'-DDE in brook trout are observed in the Site Study Reach relative to Reference. The same observation is made between Reaches in 1995 except that more pesticides are detected in both life stages of brook trout in 1995. Lower average whole body concentrations of methoxychlor and heptachlor epoxide are observed in juvenile brook trout in the Site Study Reach in 2007 relative to Reference.

Conclusions

Average whole body concentrations of arsenic, chromium, nickel, and vanadium are overall higher by a factor of two to six in brook trout in both Reaches in 2007 compared to 1995. On the other hand, average concentrations of strontium are lower by a factor of one-third in 2007 compared to 1995.

Average whole body concentrations of DDT and its metabolites are lower by a factor two to 10 fold in the Site Study Reach in 2007 compared to 1995. Total chlordane and dieldrin are lower by a factor of five to 10 in both Reaches in 2007 compared to 1995.

LITERATURE CITED

Belford D.A. and W.R. Gould. 1989. An evaluation of trout passage through six highway culverts in Montana. *N. Amer. J. Fish. Manage.* 9(4):437-445.

U.S. Environmental Protection Agency (USEPA). 2007. *Quality Assurance Project Plan (QAPP), Mere Brook Brunswick Naval Air Station*, Brunswick, ME. Collection of Fish for Analysis of Pesticides and Metals. June 28, 2007.

USEPA 1995. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors*, Office of Water EPA-820-8-95-005.

Mierzykowski, E.S., Prior, F.T., Munney L.K., and C.K. Carr. 1997. Environmental *Contaminants in Fish from Mere Brook, U.S. Naval Air Station Brunswick, Maine*. USFWS Special Project Report: FY97-MEFO-3-EC, New England Field Office. Old Town, ME 44 pp.

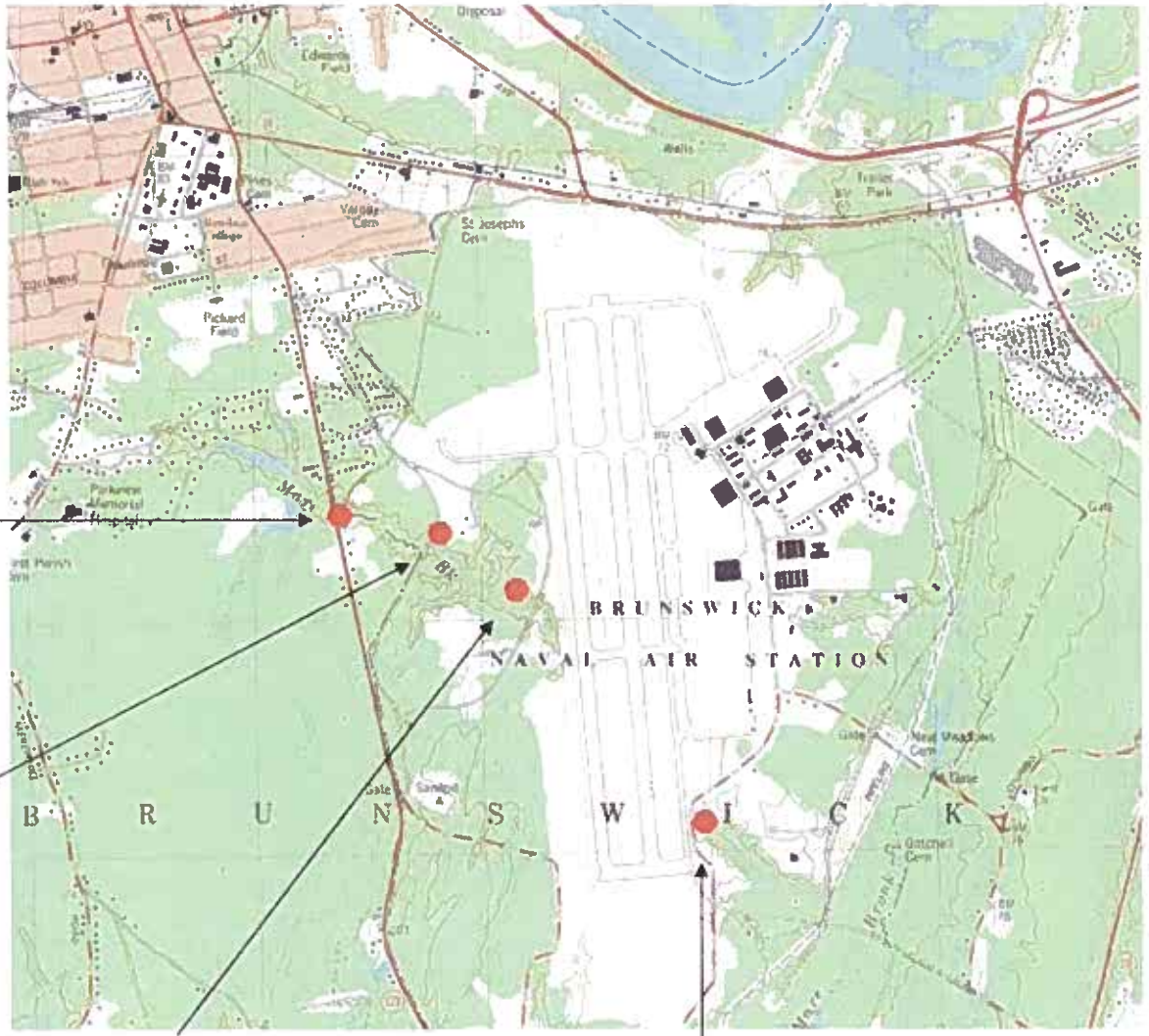
USFWS. 1982. *Fish Hatchery Management, Chapter 2 – Hatchery Operations*, Eds. R.G. Piper et al., ISBN 0-913235-03-2, U.S. Department of Interior, Washington, DC.

Figures

Draft Mere Brook Study Report 2007

U.S. Naval Air Station, Brunswick, Maine

BNAS
Waypoints
Datum: WGS 84



Rt. 123 (off base)
43° 53' 42.9" / 069° 57' 12.7"

Base perimeter road
43° 53' 40.4" / 069° 56' 53.0"

Flooded reach before culvert under runway
43° 53' 32.2 ' / 069° 56' 37.8"

East outlet of culvert 43° 53' 00.0" / 069° 56' 00.4"

Figure 1: Mere Brook Study 2007, waypoint coordinates
(courtesy of Steve Mierzykowski, U.S. Fish & Wildlife Service)

Figure 2: Mere Brook Study 2007, Reference and Site (Study) Reaches

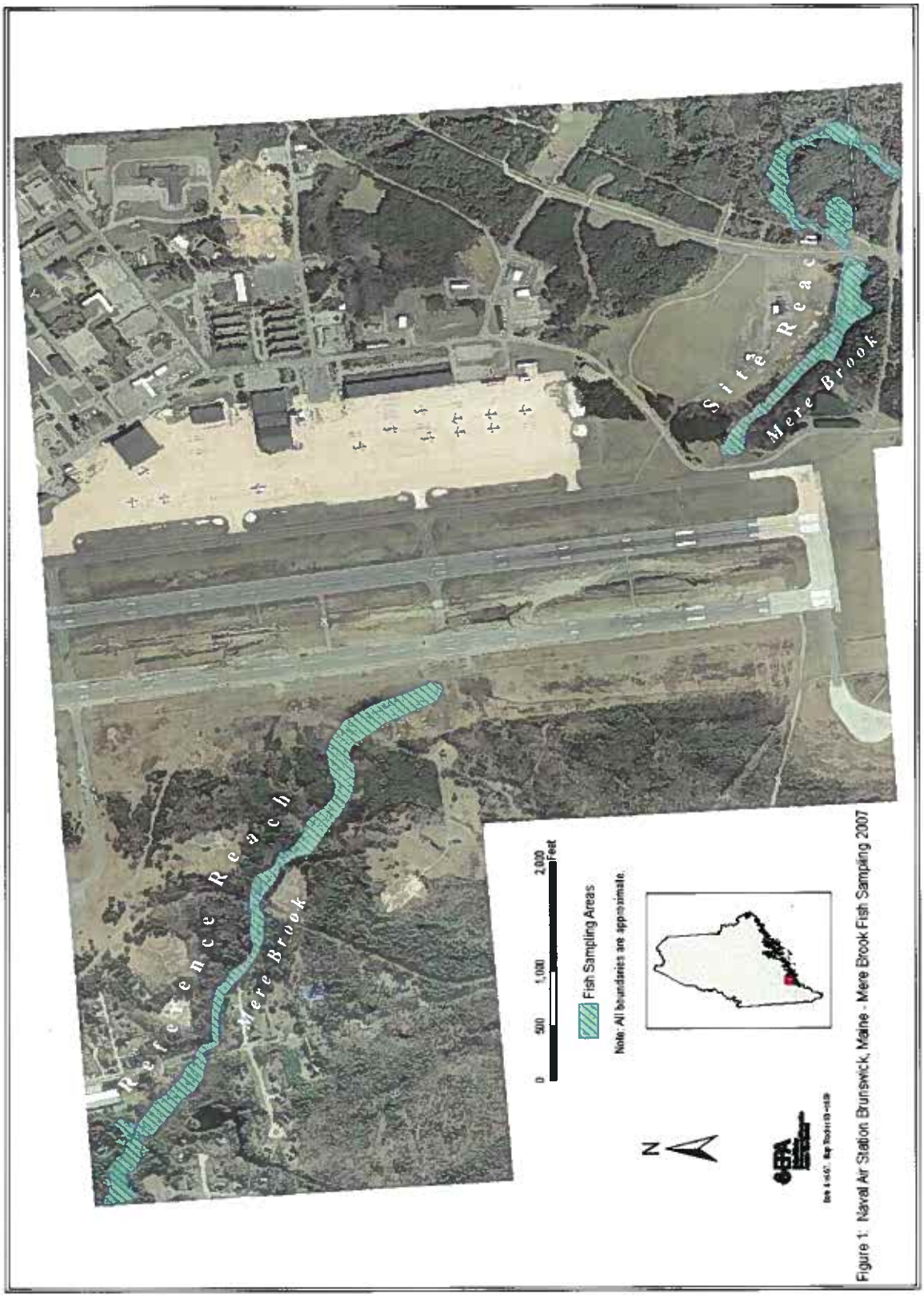


Figure 3: Length vs. Weight of Adult Eastern Brook Trout from Mere Brook

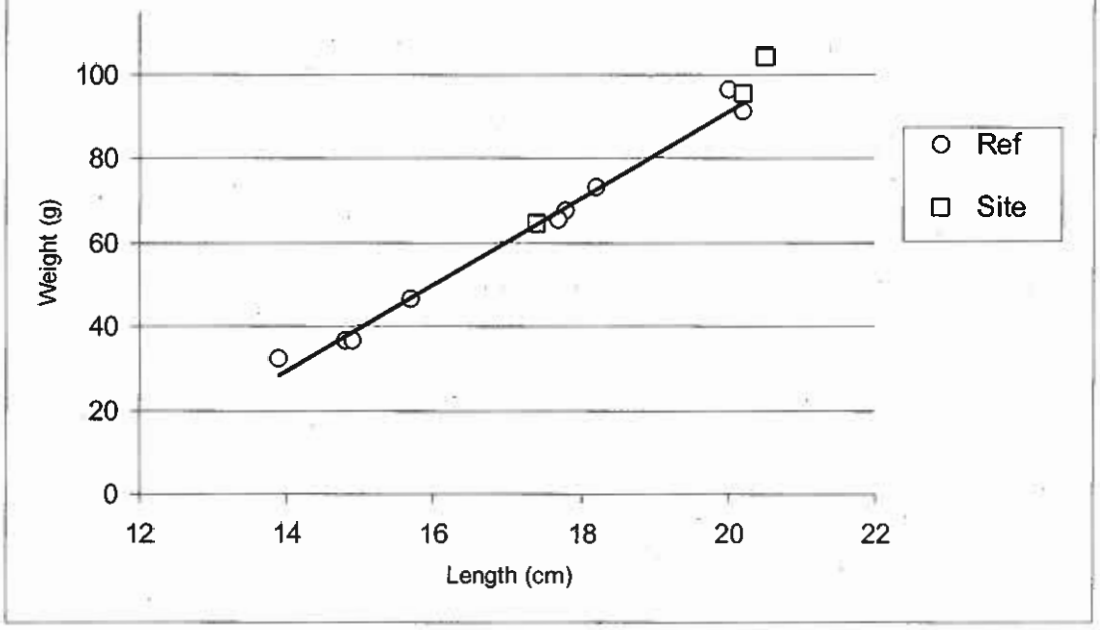


Figure 4: Condition factor in adult brook trout captured in Mere Brook in 2007

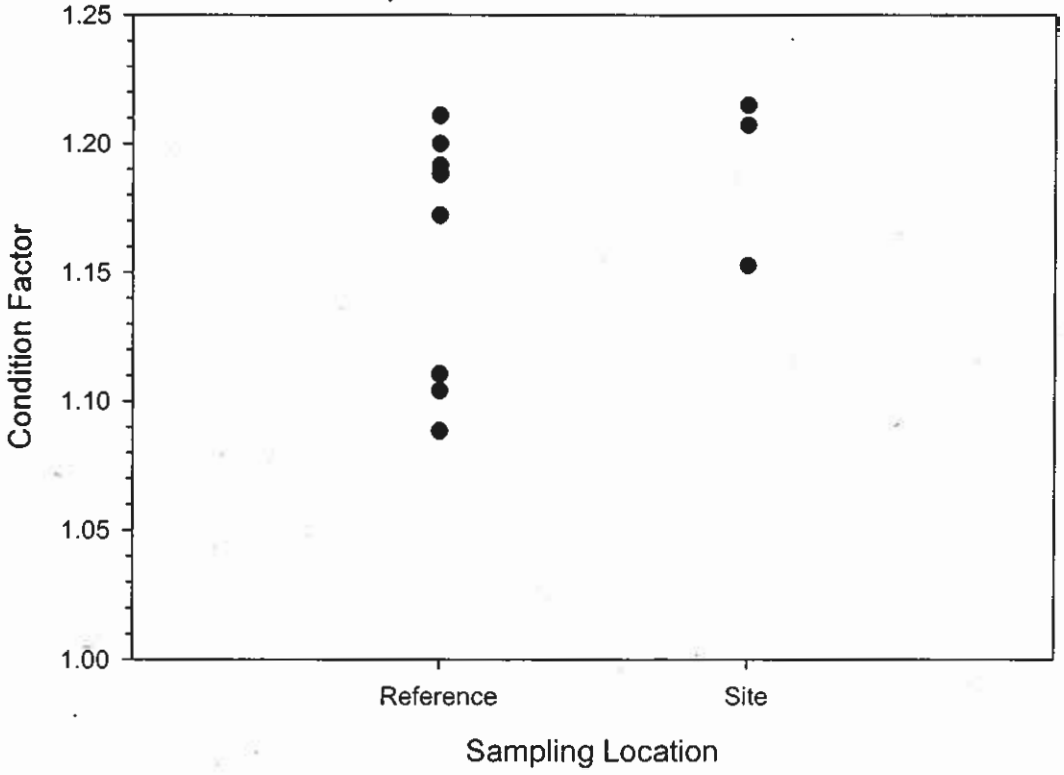


Figure 5.a: Mean +/- 1 S.D. for target metals in juvenile brook trout collected from Mere Brook

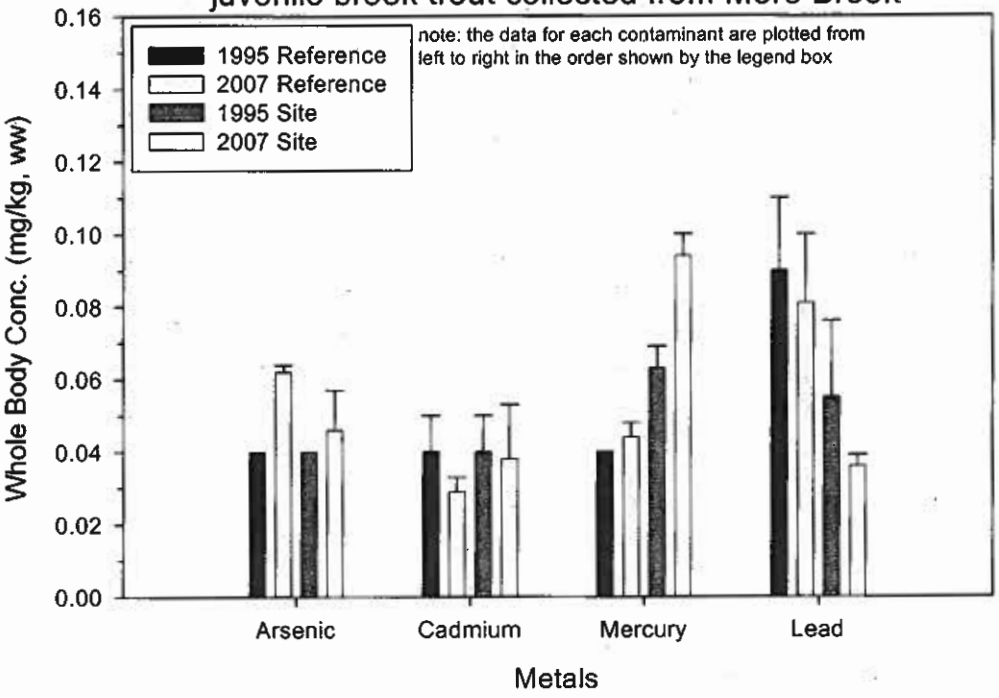


Figure 5.b: Mean +/- 1 S.D. for target metals in adult brook trout collected from Mere Brook

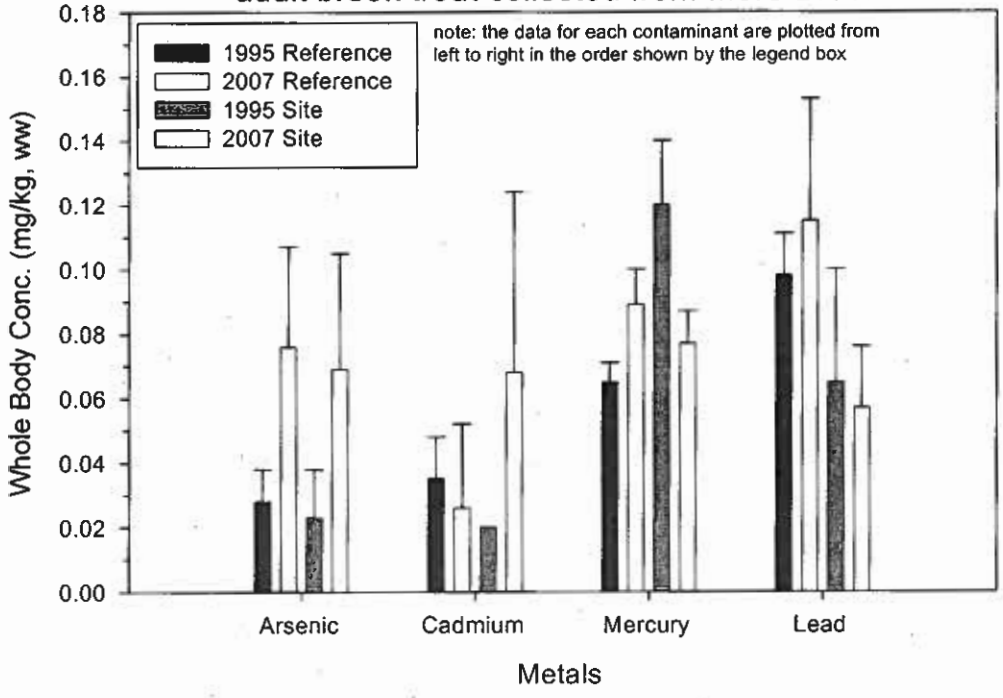


Figure 6.a: Mean +/- 1 S.D. for target metals in juvenile brook trout collected from Mere Brook

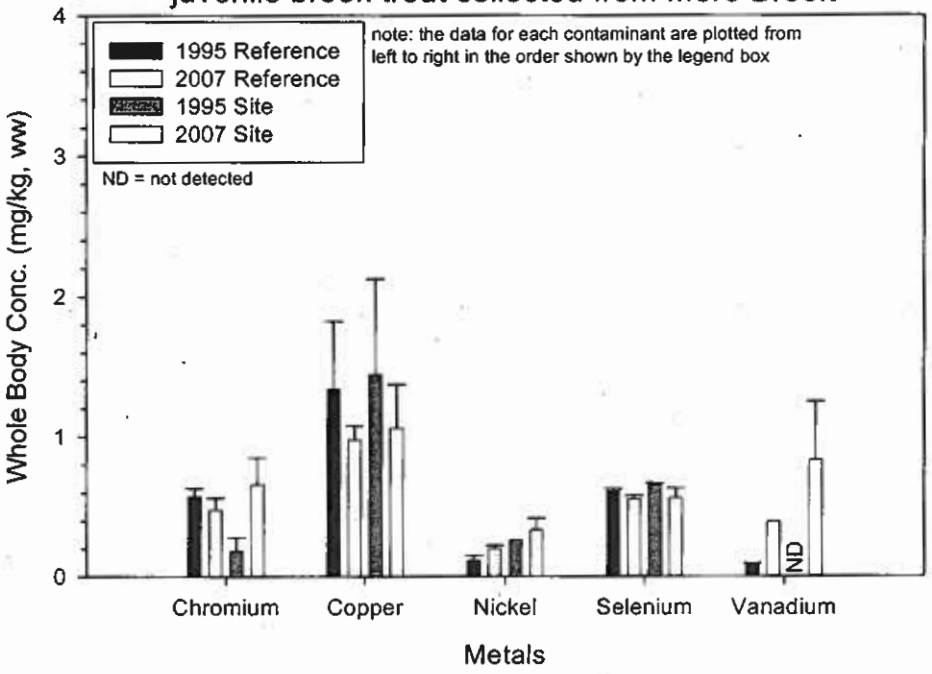


Figure 6.b: Mean +/- 1 S.D. for target metals in adult brook trout collected from Mere Brook

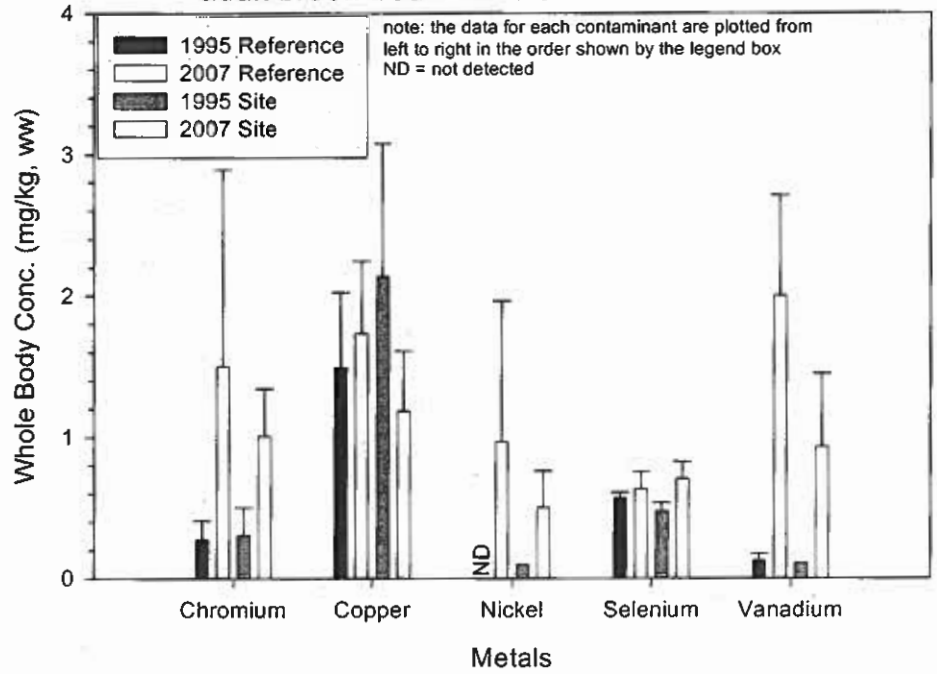


Figure 7.a: Mean +/- 1 S.D. for target metals in juvenile brook trout collected from Mere Brook

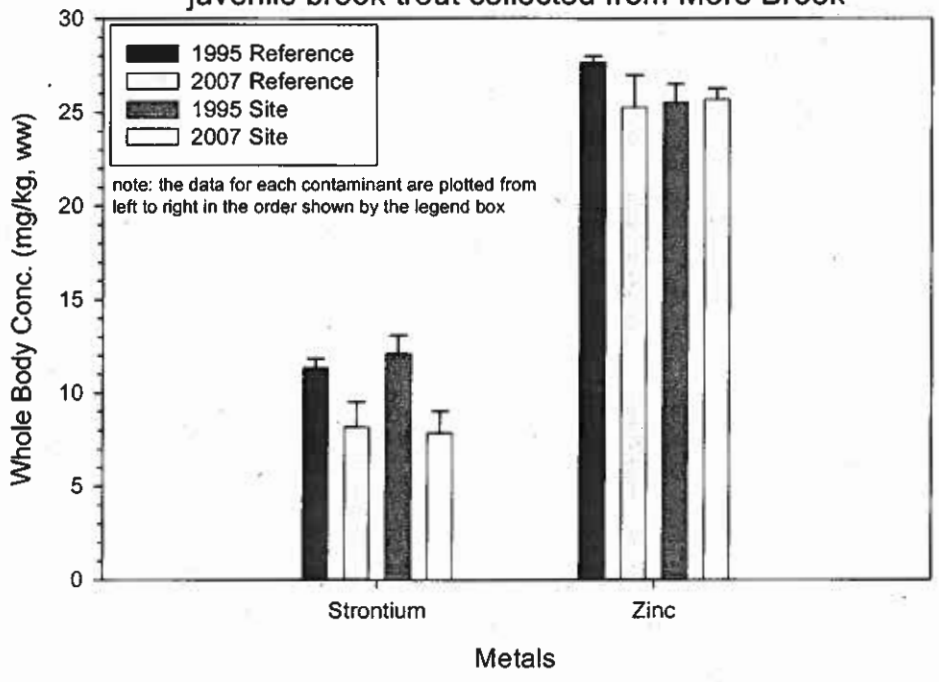


Figure 7.b: Mean +/- 1 S.D. for target metals in adult brook trout collected from Mere Brook

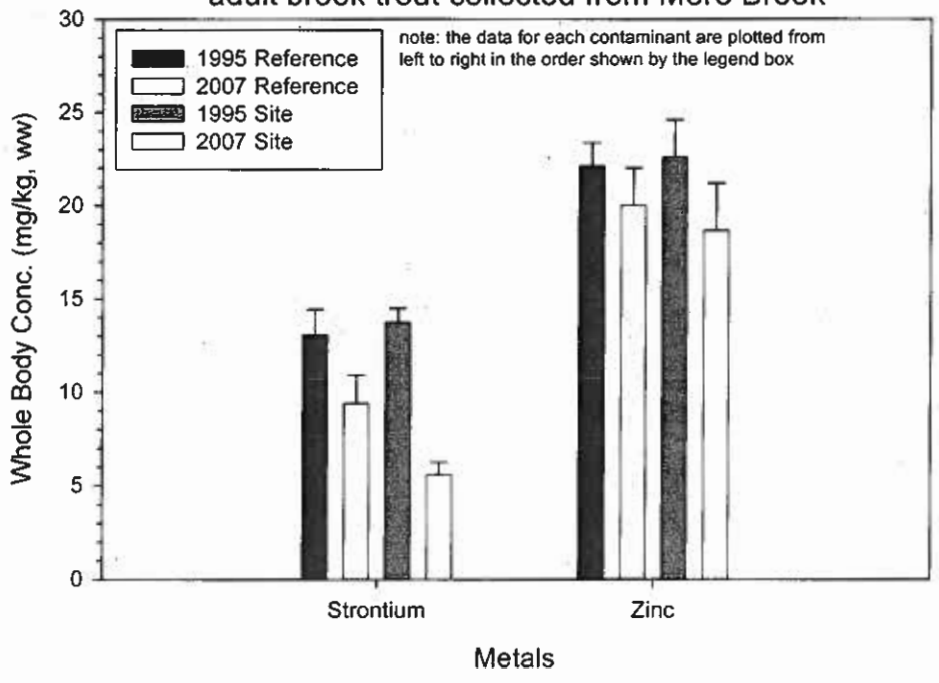


Figure 8.a: Mean +/- 1 S.D. for target pesticides in juvenile brook trout collected from Mere Brook (not normalized for lipids)

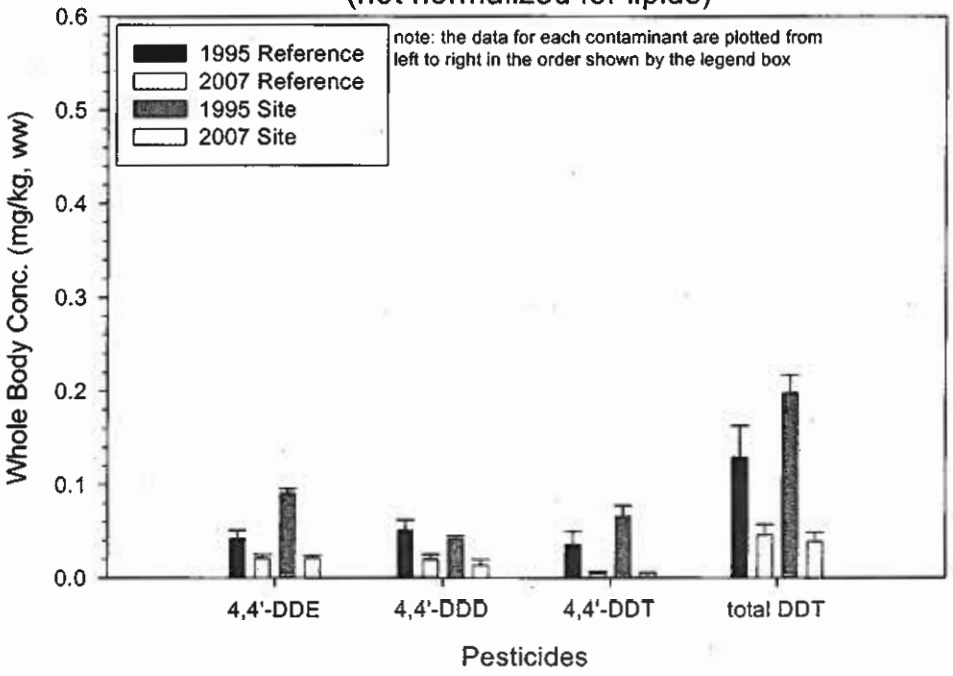


Figure 8.b: Mean +/- 1 S.D. for target pesticides in adult brook trout collected from Mere Brook (not normalized for lipids)

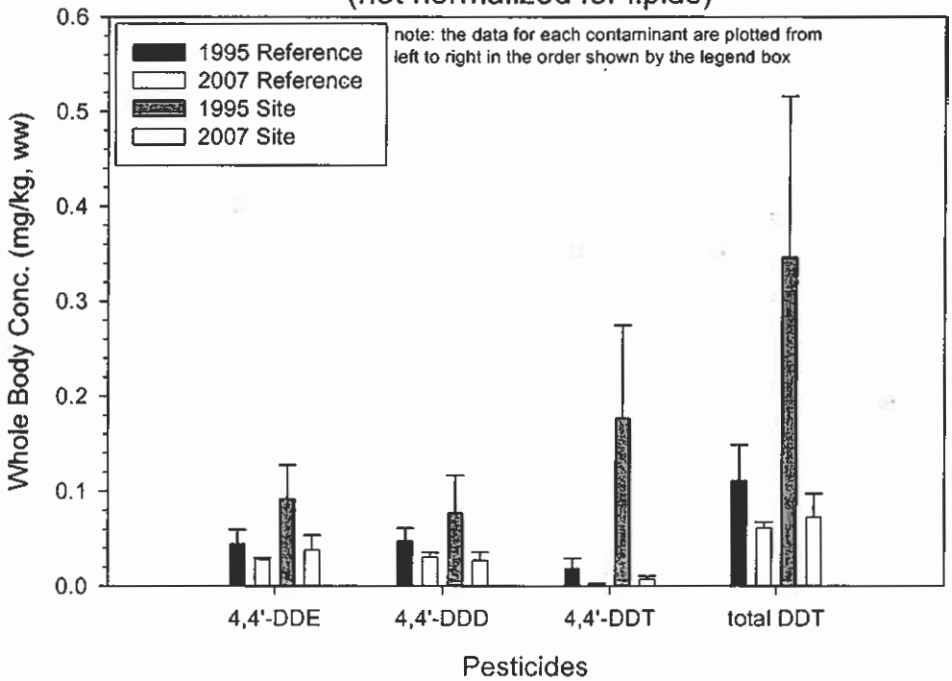


Figure 9.a: Mean +/- 1 S.D. for target pesticides in juvenile brook trout collected from Mere Brook (normalized for lipids)

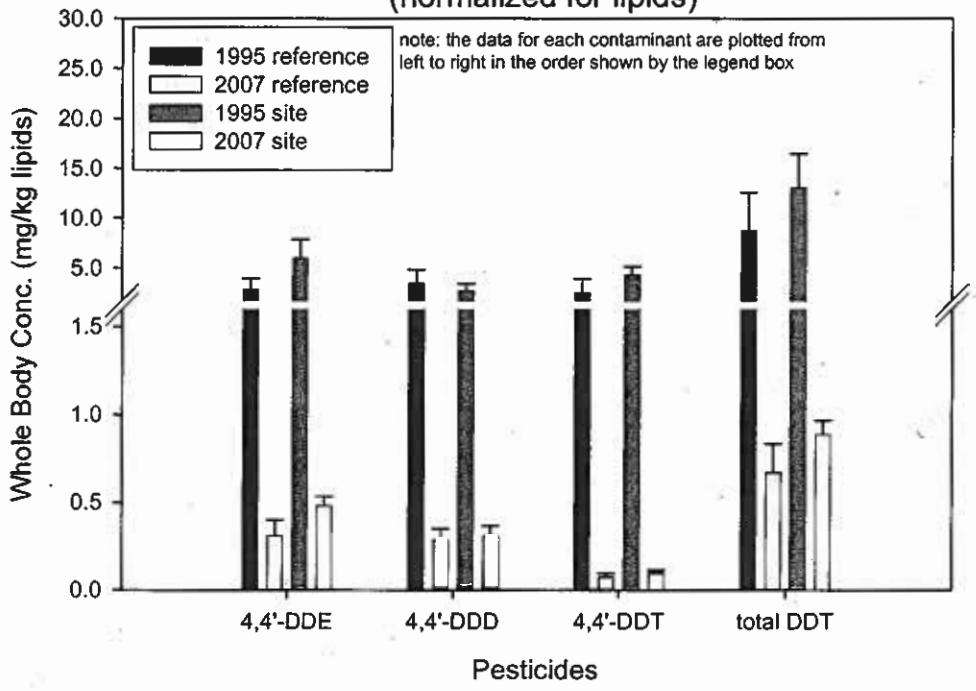


Figure 9.b: Mean +/- 1 S.D. for target pesticides in adult brook trout collected from Mere Brook (normalized for lipids)

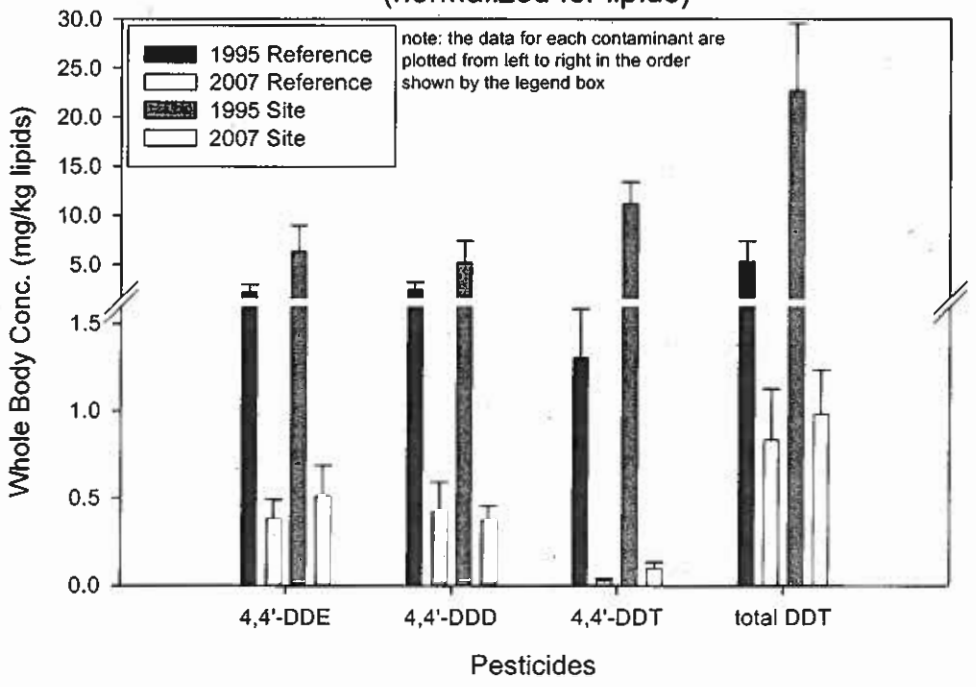


Figure 10.a: Mean +/- 1 S.D. for target pesticides in juvenile brook trout collected from Mere Brook (not normalized for lipids)

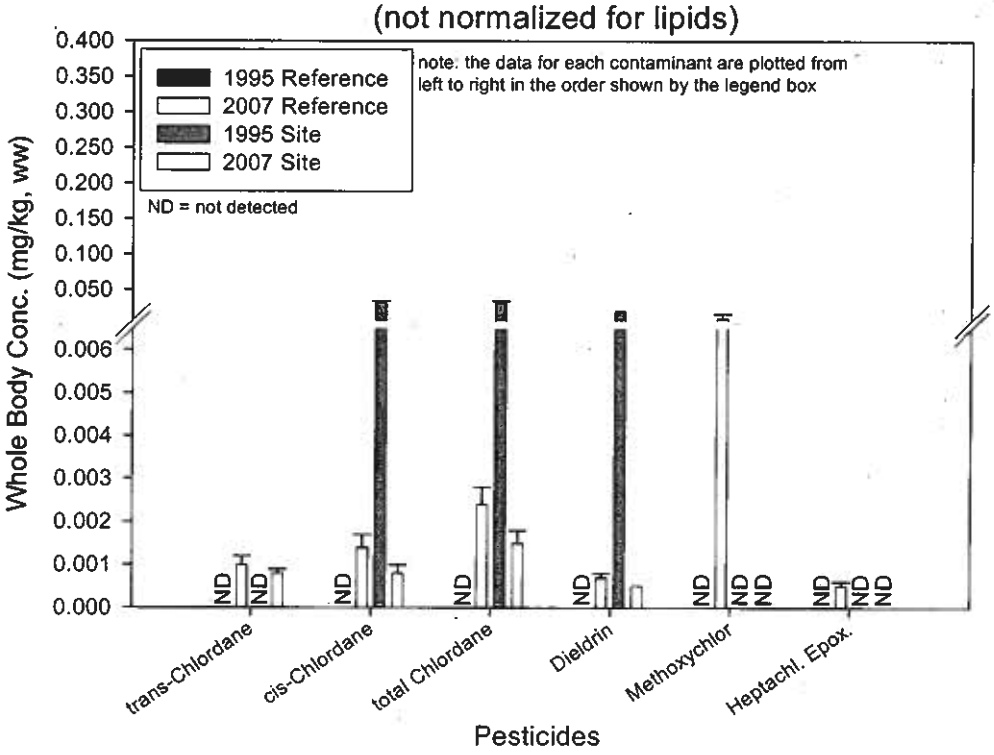


Figure 10.b: Mean +/- 1 S.D. for target pesticides in adult brook trout collected from Mere Brook (not normalized for lipids)

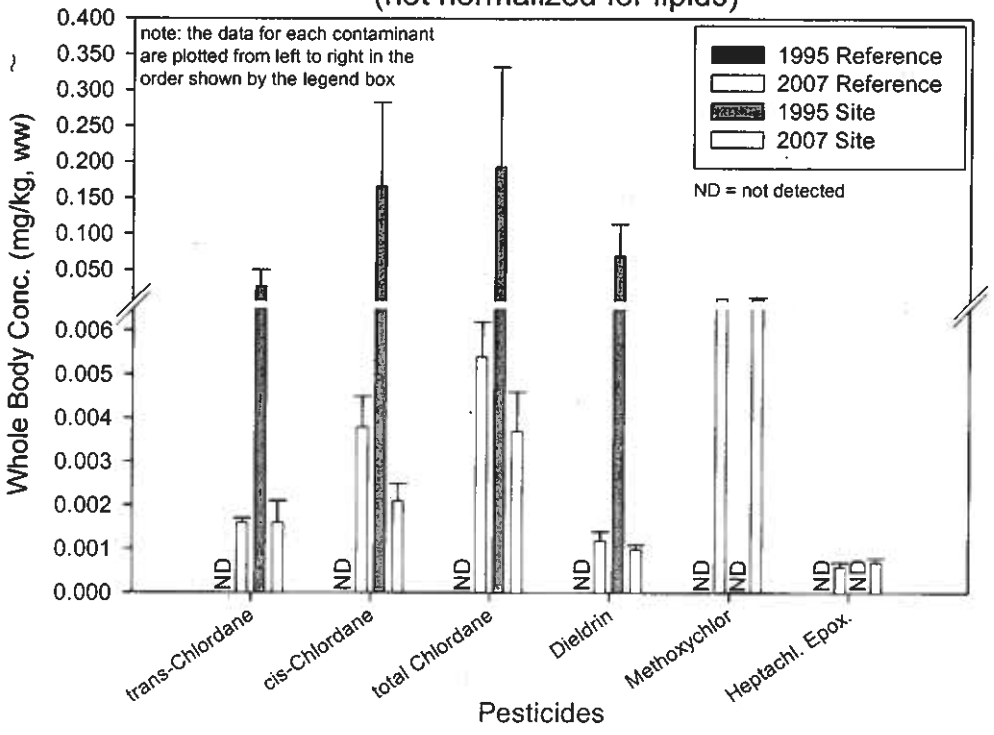


Figure 11.a: Mean +/- 1 S.D. for target pesticides in juvenile brook trout collected from Mere Brook (normalized for lipids)

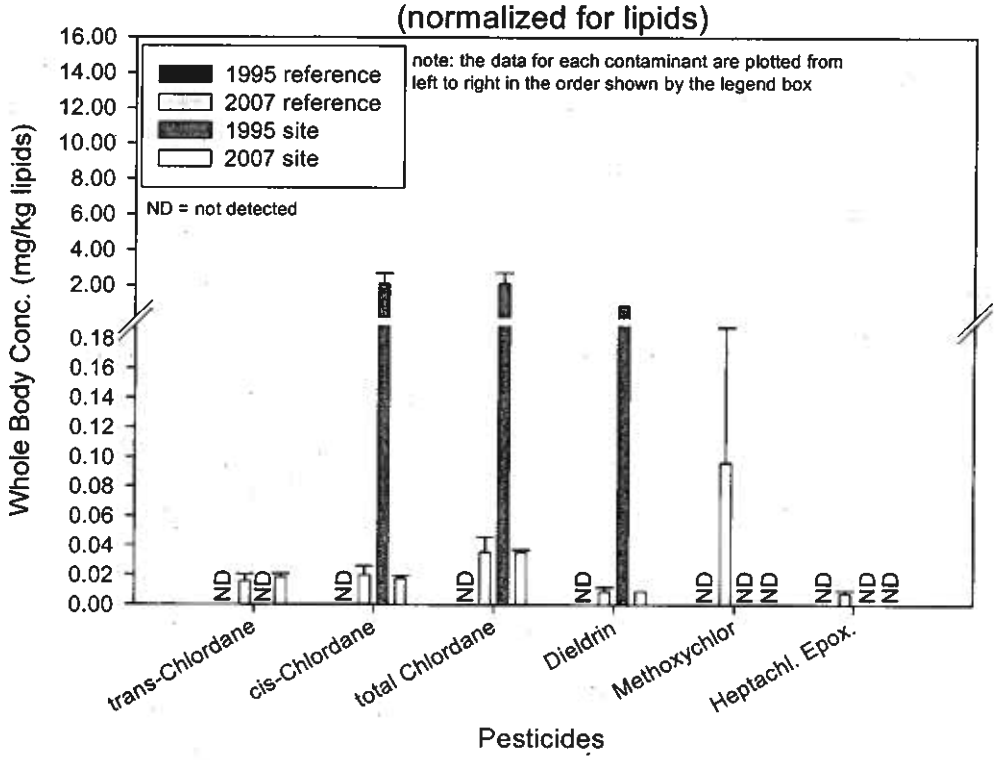
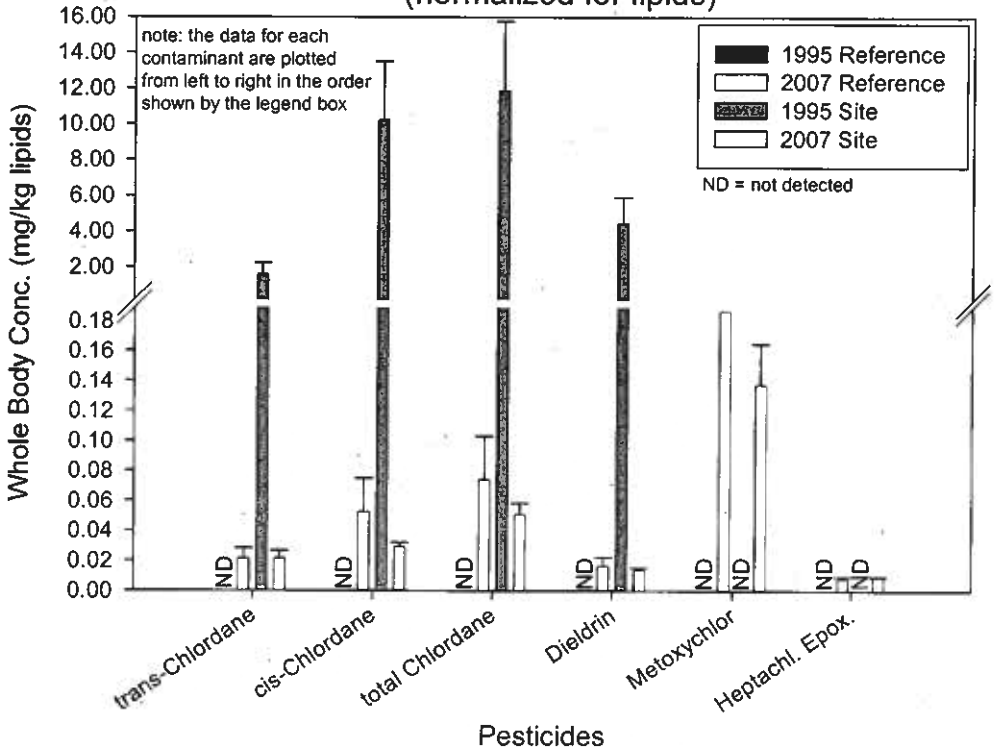


Figure 11.b: Mean +/- 1 S.D. for target pesticides in adult brook trout collected from Mere Brook (normalized for lipids)



Tables

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13.9-20.5	67	32-104	6
5.5-8.5	3.9	NA	7

vere weighed as composite samples and not as individuals.

-2	Reference	Adult	3	17.8, 18.2, 14.8	67, 73, 36 [176]
-3	Reference	Adult	3	20.0; 17.7, 14.9	96, 65, 36 [197]
-1	Reference	Juvenile	20	NA	[80]
-2	Reference	Juvenile	20	NA	[85]
-3	Reference	Juvenile	20	NA	[70]
UP	Reference	Juvenile	20	NA	[75]
-1	Site Study	Adult	1	20.5	[104]
-2	Site Study	Adult	1	20.2	[95]
-3	Site Study	Adult	1	17.4	[64]
-1	Site Study	Juvenile	3	NA	[15]
-2	Site Study	Juvenile	4	NA	[15]
-3	Site Study	Juvenile	4	NA	[14]

e individuals is not available.

.2	0.05	J	0.03	0.56	1.6	J	0.09	J	0.25	0.07	0.66	9.2	ND (0.32)	22	J
.7	0.07	J	0.03	3.1	1.3		0.08	J	2.1	0.15	0.50	8.0	2.5	18	J
n=3															
Mean	0.08		0.03	1.50	1.73		0.09		0.97	0.11	0.63	9.40	2.00	20	
SD	0.03		0.00	1.39	0.51		0.01		0.99	0.04	0.12	1.51	0.71	2.00	
.9	0.05	J	0.05	1.2	1.2		0.07	J	0.73	0.04	0.73	4.9	1.5	16	J
.3	0.04	J	0.13	1.2	0.75		0.08	J	0.56	0.07	0.57	6.2	0.80	21	J
.4	0.11		0.02	0.62	1.6		0.08	J	0.22	0.06	0.81	5.7	0.49	19	J
n=3															
Mean	0.07		0.07	1.01	1.18		0.08		0.50	0.06	0.70	5.60	0.93	18.67	
SD	0.04		0.06	0.33	0.43		0.01		0.26	0.02	0.12	0.66	0.52	2.52	

t.

Value listed in parentheses is the sample detection limit.

limitations identified in the quality control review.

6.5	0.06	J	0.03	0.56	1.1	0.05	J	0.20	0.09	0.58	9.7	ND (0.52)		23	J
7.0	0.06	J	0.03	0.36	0.86	0.05	J	0.17	0.10	0.53	6.6	0.39	J	23	J
6.6	0.06	J	0.03	0.46	0.95	0.05	J	0.20	0.06	0.53	8.8	ND (0.062)		26	J
7.0	0.06	J	0.03	0.52	1.0	0.04	J	0.22	0.07	0.57	J 7.6	ND (0.12)		27	J
n=4															
Mean	0.06		0.03	0.48	0.98	0.04		0.20	0.08	0.55	8.18	0.39		25.25	
SD	0.00		0.00	0.09	0.10	0.00		0.02	0.02	0.03	1.36			1.71	
lls)															
5.9	0.03	J	0.03	0.48	1.4	0.10	J	0.32	0.03	0.48	7.9	1.3		25	J
7.1	0.05	J	0.06	0.86	0.79	0.10	J	0.42	0.04	0.62	6.6	0.68		26	J
6.1	0.05	J	0.03	0.63	0.99	0.09	J	0.26	0.04	0.58	9.0	0.50		26	J
n=3															
Mean	0.05		0.04	0.66	1.06	0.09		0.33	0.04	0.56	7.83	0.83		25.67	
SD	0.01		0.02	0.19	0.31	0.01		0.08	0.00	0.07	1.20	0.42		0.58	

weight.

s. Values listed parentheses is the sample detection limit.

ue to limitations identified in the quality control review.

	0.0280		0.0024		0.0610		0.0038		0.0016		0.0054		0.0012		0.0006		0.0110	
	0.0020		0.0006		0.0064		0.0007		0.0001		0.0008		0.0002		0.0001			
ls)																		
	0.0260		0.0099	J	0.0579	J	0.002		0.0012	J	0.0032	J	0.0009	J	0.0007	J	0.0078	J
	0.0560		0.0083	J	0.1013	J	0.0026		0.0021	J	0.0047	J	0.0011		0.0008	J	0.012	J
	0.0310		0.0039	J	0.0579	J	0.0018		0.0014	J	0.0032	J	0.0010	J	0.0006	J	0.010	J
	0.0377		0.0074		0.0724		0.0021		0.0016		0.0037		0.0010		0.0007		0.0099	
	0.0161		0.0031		0.0251		0.0004		0.0005		0.0009		0.0001		0.0001		0.0021	

veight.

D+ 4,4' DDT

. Values listed in parentheses is the sample detection limit.

e to limitations identified in the quality control review.

4'DDT being qualified.

e to trans-chlordane being qualified.

0.2813	0.2917	0.0302	J	0.6031	J	0.0354	0.0156	J	0.0510	J	0.0104	0.0065	J	ND (0.0036)	
0.4244	0.3808	0.0315		0.8366		0.0527	0.0214		0.0741		0.0165	0.0082		0.1864	
0.1686	0.1135	0.0086		0.2886		0.0224	0.0068		0.0291		0.0058	0.0015			
ills)															
0.2973	0.3514	0.1338	J	0.7824	J	0.027	0.0162	J	0.0432	J	0.0126	J	0.0089	J	0.1054	J
0.4625	0.7000	0.1038	J	1.2663	J	0.0325	0.0263	J	0.0588	J	0.0138		0.0094	J	0.1500	J
0.3594	0.4844	0.0609	J	0.9047	J	0.0281	0.0219	J	0.0500	J	0.0153	J	0.0086	J	0.1563	J
0.3731	0.5119	0.0995		0.9845		0.0292	0.0215		0.0507		0.0139	0.0090		0.1372	
0.0834	0.1759	0.0366		0.2516		0.0029	0.0051		0.0078		0.0014	0.0004		0.0277	

wet weight.

DD+ 4,4' DDT

s. Values listed In parentheses is the sample detection limit.

ue to limitations identified in the quality control review.

,4'DDT being qualified.

ue to trans-chlordane being qualified.

0	0.0170	0.003	J	0.0340	J	0.001	0.0008	J	0.0018	J	ND (0.0004)		0.0004	J	ND (0.0036)
8	0.0210	0.0052		0.0459		0.0014	0.0010		0.0024		0.0007		0.0005		0.0089
1	0.0042	0.0016		0.0105		0.0003	0.0002		0.0004		0.0001		0.0001		0.0072
ills)															
0	0.0240	0.0056	J	0.0496	J	0.001	0.0009	J	0.0019	J	0.0005	J	ND (0.0004)		0.0019
0	0.0180	0.0031	J	0.0311	J	0.0007	0.0007	J	0.0014	J	ND (0.0004)		ND (0.0004)		0.0019
0	0.0200	0.0041	J	0.0351	J	0.0006	0.0008	J	0.0014	J	ND (0.0004)		ND (0.0004)		0.0002
7	0.0207	0.0043		0.0386		0.0008	0.0008		0.0015		0.0005				0.0013
5	0.0031	0.0013		0.0097		0.0002	0.0001		0.0003						0.0010

weight.

D+ 4,4' DDT

s. Values listed in parentheses is the sample detection limit.

ue to limitations identified in the quality control review.

,4'DDT being qualified.

ue to trans-chlordane being qualified.

3415	0.4146	0.0732 J	0.8293 J	0.0244	0.0202 J	0.0446 J	ND (0.0004)	0.0100 J	ND (0.0036)
2861	0.3105	0.0740	0.6705	0.0200	0.0156	0.0356	0.0088	0.0075	0.0963
0639	0.0876	0.0211	0.1634	0.0057	0.0046	0.0102	0.0029	0.0021	0.0914
3700	0.4440	0.1040 J	0.9190 J	0.019	0.016 J	0.0340 J	0.0090 J	ND (0.0004)	ND (0.0037)
2560	0.4620	0.0790 J	0.7970 J	0.018	0.018 J	0.0360 J	ND (0.0004)	ND (0.0004)	ND (0.0037)
2970	0.5410	0.1110 J	0.9490 J	0.016	0.021 J	0.0370 J	ND (0.0004)	ND (0.0004)	ND (0.0038)
3077	0.4823	0.0980	0.8883	0.0177	0.0183	0.0357	0.0090		
0577	0.0516	0.0168	0.0805	0.0015	0.0025	0.0015			

ght.

DDT

Values listed is the sample detection limit.

itations identified in the quality control review.

being qualified.

ns-chlordane being qualified.

THE ECOS and DoD SUSTAINABILITY WORKGROUP

ISSUE PAPER

Initiation of Emerging Contaminants Characterization and Response Actions for Protection of Human Health

Introduction:

The ECOS-DoD Sustainability Work Group was formed in 2004 in an effort to forge partnerships to "exchange information and ideas across state and jurisdictional boundaries and to further solutions to create sustainable bases and ranges in harmony with local communities."[1] This effort is being applied across two issue areas, each represented by a Task Group: Compatible Use and Sustainability, and Emerging Contaminants. This issue paper is one in a series of papers being developed by the ECOS-DoD Sustainability Work Group's Emerging Contaminants (EC) Task Group.

The EC Task Group seeks to develop a common understanding of the underlying facts and issues, and develop mutually acceptable processes to address emerging contaminants. Clarity and understanding of the issues will increase public confidence in federal and state governments' abilities to protect public health and the environment and help sustain DoD's primary mission of national defense. Each paper frames an issue identified at the 2005 ECOS Emerging Contaminants Forum as a priority for discussion among the parties.

The following working definition for emerging contaminants was agreed to by participants of the ECOS-DoD work group:

Emerging Contaminants are chemicals or materials of interest that are characterized by:

- *a perceived or real threat to human health or environment, and*
- *there is no currently published health standard or there is an existing health standard, but the standard is evolving or being re-evaluated.*

Emerging contaminants may have insufficient or limited human health or environmental information available. They may also become of interest because a new source, pathway or detection limit has been discovered.

Issue:

Many ECs don't have health-based risk levels (e.g., reference doses [RfDs]) or established standards (e.g., Maximum Contaminant Levels [MCLs]). Thus, it is often not clear to some field personnel if action should be taken requiring the use of funds, especially for actions not previously identified in budgets, or what concentration may trigger site characterization or cleanup. This paper examines some key conditions, considerations, statutory authorities, or criteria that could be used to evaluate potential characterization and response actions with a related expenditure of funds[2]. The goal is for

[1] ECOS Resolution 04-8, http://www.ecos.org/files/1192_file_Copy_of_Resolution_04_8.pdf

[2] *Respond* or *Response* as defined by section 101(25) of CERCLA, means remove, removal, remedy, and remedial action, and all such terms (including removal and remedial action) including enforcement activities related thereto.

DoD and regulators to provide recommendations for a common-sense, protective, policy/practice framework that is supported by, and consistent with, existing statutes, regulations and guidance.

Scope:

This initial paper is focused only on the human health aspects of ECs as defined above. It does not cover natural resources, ecological risk, beneficial use, anti-degradation issues that may also trigger response action on emerging contaminants. The paper covers characterization and cleanup activities conducted under the Defense Environmental Restoration Program (DERP); the Comprehensive Environmental Response Compensation and Liability Act (CERCLA); the Resource Conservation and Recovery Act (RCRA); related state cleanup laws; and parts of other federal/state laws that may involve characterization and cleanup of sites. It does not cover non-cleanup related activities, such as drinking water monitoring carried out solely for regulatory purposes under the Safe Drinking Water Act. The paper is intended to be used by DoD, EPA, and state regulatory personnel to help inform decisions related to characterization and response actions for ECs. It is also anticipated that the paper may support future EC policies by these parties.

Background:

The following provides a summary of some of the key considerations regarding triggers for action, response selection, and funding. However, for a more complete and detailed understanding, please refer to existing language in the statute, regulatory preamble and regulatory text, and guidance.

Environmental Statutes and Regulations

- Several statutes provide requirements for site characterization and cleanup of ECs.

- Under CERCLA, the federal government has broad authority to undertake a response action consistent with the National Oil and Hazardous Substances Spill Contingency Plan (NCP) where there is a release or threat of release of a hazardous substance, or a release or substantial threat of a release of any "pollutant or contaminant" which may present an imminent and substantial danger to public health or welfare. Many state cleanup laws have similar provisions.

- The NCP states in 40 CFR 300.430 (d)(4) that "Using the data developed under paragraphs (d)(1) (Remedial Investigation) and (d)(2) (Site Characterization) of this section the lead agency shall conduct a site-specific baseline risk assessment to characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain. The results of the baseline risk assessment will help establish acceptable exposure levels for use in developing remedial alternatives in the FS." Chemical specific standards that define acceptable risk levels (e.g., MCLs) also may be considered in determining the risk to human health or the environment posed by actual or potential exposure to contamination at a site.

- On-site response actions under CERCLA generally comply with Applicable or Relevant and Appropriate Requirements (ARARs) unless those ARARs are waived. However, many ECs are not addressed by ARARs.

- Under CERCLA and the NCP, nine criteria are considered when evaluating alternatives in the remedy selection process. The selected remedies must meet the threshold criteria of protecting human health and the environment, and complying with ARARs.

- Cleanup levels also may be based on "to be considered" (TBCs) information, which may include non-promulgated criteria, advisories, guidance and proposed standards issued by Federal or State governments. While TBCs are not considered ARARs because, among other things, they are not promulgated regulations, nor are they legally enforceable, they still can be helpful in developing protective remedies.

- As a policy matter, "it is similarly appropriate to treat Indian tribes as states for purposes of identifying ARARs under section 121(d)(2)." (55 FR 8741)

- States have also adopted cleanup statutes and regulations, most of which are also risk-based and have requirements similar to CERCLA. Many states have toxicology, standard setting, and risk assessment programs, which focus on state or local environmental problems involving contaminants that have not been addressed by EPA.

- DoD generally is subject to the requirements of RCRA, and routinely samples and analyzes material in order to determine if it constitutes hazardous waste. Where emerging contaminants are not RCRA "listed" hazardous wastes, they may still be a RCRA-regulated characteristic waste (characteristics include toxicity, corrosiveness, reactivity, and ignitability).

- In addition to CERCLA and RCRA, there are a number of other state and federal laws that authorize regulatory agencies to undertake characterization or response action, or require others to take action, when there is a threat or potential threat to human health or the environment.

<u>DoD Characterization and Cleanup Programs</u>

- The DERP statute provides the program structure and goals (including the funding accounts) for carrying out environmental restoration activities subject to, and consistent with, CERCLA. 10 U.S.C 2701 provides the statutory authority for DoD to identify, investigate, research and develop and clean up hazardous substances, pollutants or contaminants, where emerging contaminants may qualify as hazardous substances, pollutants or contaminants as defined by CERCLA.

- In DoD's environmental program, funding is justified by statutory and regulatory requirements. Budget reviewers want to know which laws or regulations require a project or action to be funded.

- DoD has a complicated and robust Planning, Programming and Budgeting System (PPBS). Resource planning is done for a six-year window called the Future Year Defense Plan (FYDP).

- The timing of the Federal budget cycle means that key resource decisions are made well in advance of the current budget year. For example, key DoD decisions for FY 2008 were made in the Jan-Feb 2006 time frame. Based on the decisions for funding levels for specific programs, the detailed DoD FY-08 budget was prepared during the summer of 2006 and became a part of the President's Budget for FY2008, presented to Congress in February 2007. This timing creates challenges for DoD installations when unplanned needs arise after the budget has been approved by Congress.

- Cleanup and compliance projects are usually known well in advance and are reflected in federal planning and budget decisions. New requirements that arise after budget preparation must be accommodated within a given fiscal year's budget controls and thus other work must be deferred. In other words, it is a "zero-sum" game for federal agencies.

Discussion:

- State and Federal regulators expect that Federal agencies and potentially responsible parties will respond in a timely manner to their requests to assess current or potential sites or provide information on known or suspected releases or take response actions. However, most regulators are understanding of the federal budget cycle challenges, and generally will take this into consideration in developing reasonable timeframes for addressing contamination, depending on site-specific circumstances.

- Existing laws and regulations provide flexibility and authorities for DoD to take appropriate action requiring the expenditure of funds to protect public health and the environment and/or for regulators to take or require actions to protect public health.

- For many ECs, professional judgment may be an important component and may weigh heavily in establishing protective levels based on the state-of-the science for an EC and the site-specific threat to human health or the environment. Under CERCLA, the NCP, and Executive Order 12580, EPA and DoD both have roles and responsibilities for ensuring the protection of human health and the environment when carrying out characterization and response actions. State statutes may provide similar authority to the State regulator. DoD has the ability and authority to conduct response actions related to releases from its facilities. CERCLA section 120 and 10 USC 2705 (b) address the roles and responsibilities of DoD and EPA. In addition, DoD and EPA, have promulgated extensive policy and guidance documents elaborating on how to implement or interpret the statutes and regulations. It is important to note these policy and guidance documents do not impose requirements as do the statutes and regulations.

- Regulatory or health agencies have the ability and authority to determine whether the science for an EC is sufficient to determine risk to human health and whether a specific site presents a threat to public health, and normally do so in coordination with DoD. However, DoD may have subject matter experts for a particular EC, especially if it is a military-unique compound (e.g., explosives). Federal and state public health agencies also possess unique expertise and may provide focused public health consultations. DoD will present the available toxicological data to the appropriate regulators so that the agencies can collaborate on determining the sufficiency of the data. While DoD is mindful of budgeting requirements, it is committed to protecting human health and the environment. National and state administrative procedures exist to ensure transparency, public involvement and the use of sound science.

- Requests to fund characterization and/or response actions related to ECs can raise two problems for DoD:
  - These actions for ECs are often "emergent" and may not be identified in the budget that is prepared about 2 years in advance of the execution year. DoD does have flexibility to re-prioritize, but as a policy matter, for ECs this would normally only be done for reasons of an imminent and substantial endangerment to public health. However, DoD will take appropriate budget programming actions in subsequent years.
  - The human health science for an EC may be incomplete and related regulatory requirements (i.e., ARARs) may be lacking.

- Examples of actions that might be taken (depending on the circumstances) for ECs follow. These actions would normally be taken in conjunction with other actions to address releases or potential releases of hazardous substances, pollutants or contaminants (or hazardous or solid waste) at a site as part of the CERCLA (or RCRA) response process.

  - Toxicological studies
  - Preliminary Assessments/Site Inspections (PA/SI), including sampling
  - Remedial Investigations/Feasibility Studies (RI/FS), including risk assessments
  - Removal actions or interim measures to mitigate or eliminate exposure
  - Remedial (CERCLA) and Corrective (RCRA) actions, which may include land use controls

- At least four typical scenarios relating to response actions may exist for ECs[3].

Table 1

	EC present at levels requiring action	EC present but necessity for action uncertain
Other contaminants present at levels requiring action	Scenario 1	Scenario 2
Other contaminants not present or at levels that do not require action	Scenario 3	Scenario 4

For the purposes of this table, an EC at levels requiring action means that the parties agree action is needed.

The scenarios below include potential use of interim remedies or possibly involve the delay of remedies. Furthermore, it is anticipated that using the best available current science typically should facilitate reaching agreement as to whether response action is warranted and determining appropriate, protective cleanup levels. Consistent with CERCLA section 121(c) and the NCP, remedial actions will be reviewed to ensure continued protectiveness.

Scenario 1

- In scenario 1, other contaminants trigger a response action.

[3] Note that under CERCLA remedies must be evaluated using nine criteria in the NCP. While the modifying criteria of cost is an important consideration from a budgeting standpoint, remedies first and foremost must meet the primary criterion of being protective of human health and the environment. Thus protectiveness is a threshold criterion under the NCP.

- The concentrations of ECs are sufficiently elevated such that all parties agree that action is necessary for the ECs.
- Remedial alternatives for other contaminants may address ECs.
- Remedial alternatives for other contaminants may not address ECs, in which case an alternate remedy needs to be evaluated.
- If there is agreement on the EC cleanup level by the parties, a remedy is implemented.
- If the parties disagree on the ultimate cleanup level for the EC, one or more interim response actions may be appropriate until risk-based values are identified for the EC (e.g., plume migration control, provision of drinking water, land use controls, monitoring).
- If the parties agree that there is no actual or potential future exposure (for example, there is no current pathway and human receptor for ECs), it may be possible to delay further action until there is a greater certainty over the risk (e.g., more complete toxicity information). For example, if there is soil contamination or a stable plume this might be appropriate. Alternately, DoD may wish to make a risk management decision in consultation with regulatory agencies.
- At a minimum, the parties should seek to delineate or determine the extent of contamination until there is greater certainty regarding the risk. If the parties agree to delay further action until risk-based values are identified, the DoD may want note the area of contamination on their Base Master Plan or other appropriate documents

Scenario 2

- In this scenario, other contaminants trigger a response action.
- ECs are detected but regulators and DoD cannot agree that they pose an unacceptable risk (e.g. there may be incomplete science and/or a lack of peer reviewed toxicity information.
- Remedial alternatives for other contaminants may address ECs. If so, and agreement can be reached on the EC cleanup level by the parties, a remedy is implemented.
- If the parties disagree on the ultimate cleanup level for the EC one or more interim response actions may be appropriate until risk-based values are identified for the EC (e.g., monitoring, land use controls, plume migration control, provision of drinking water).
- If the remedial alternatives for other contaminants do not address ECs and the parties agree that there is no actual or potential future exposure (for example, there is no current pathway and human receptor), it may be possible to delay further action until there is a greater certainty over the risk (e.g., more complete toxicity information). Alternately, DoD may wish to make a risk management decision in consultation with regulatory agencies.
- At a minimum, the parties should seek to delineate or determine the extent of contamination until there is greater certainty regarding the risk. If the parties agree to delay further action until risk-based values are identified, the DoD may want note the area of contamination on their Base Master Plan or other appropriate documents

Scenario 3

- In scenario 3, other contaminants do not trigger a response action.
- The concentrations of ECs are sufficiently elevated such that all parties agree that action is necessary for ECs.
- Remedial alternatives need to be evaluated for ECs.
- If there is agreement on the cleanup level by the parties, a remedy is implemented.
- If the parties disagree on the ultimate cleanup level for the EC one or more interim response actions may be appropriate until risk-based values are identified for the EC (e.g., plume migration control, provision of drinking water, monitoring, land use controls).
- If the parties agree that there is no actual or potential future exposure (for example, there is no current pathway and human receptor for ECs), it may be possible to delay further action until there

is a greater certainty over the risk (e.g., more complete toxicity information). For example, if there is soil contamination or a stable plume, this might be appropriate. Alternately, DoD may wish to make a risk management decision in consultation with regulatory agencies.

- At a minimum, the parties should seek to delineate or determine the extent of contamination until there is greater certainty regarding the risk. If the parties agree to delay further action until risk-based values are identified, the DoD may want note the area of contamination on their Base Master Plan or other appropriate documents

Scenario 4

- In this scenario, other contaminants do not trigger a response action.
- ECs are detected but regulators and DoD cannot agree that they pose an unacceptable risk (e.g. there may be incomplete science and/or a lack of peer reviewed toxicity information.
- The parties should seek to agree on whether one or more interim response actions may be appropriate until risk-based values are identified for the EC (e.g., monitoring, land use controls, plume migration control, provision of drinking water).
- If the parties agree that there is no actual or potential future exposure (for example, there is no current pathway and human receptor), it may be possible to delay further action until there is a greater certainty over the risk (e.g., more complete toxicity information). Alternately, DoD may wish to make a risk management decision in consultation with regulatory agencies.
- At a minimum, the parties should seek to delineate or determine the extent of contamination until there is greater certainty regarding the risk. If the parties agree to delay further action until risk-based values are identified, the DoD may want note the area of contamination on their Base Master Plan or other appropriate documents

Summary/Recommendations:

- The parties should strive to reach agreement on how and when to sample for ECs, the means to determine the nature and scope of the risk to human health, and the response actions needed. Therefore, the following recommended approach is offered for addressing site-specific situations.

    1) Based on the site history and site inspection, determine whether there is a real or suspected release of an EC that would trigger a need for sampling at a site and whether there is an appropriate analytical method.

    2) If information exists to support sampling, develop a field sampling and analysis plan with agreed-upon data quality objectives (DQOs). The quality assurance project plan for such efforts should comply with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) and be consistent with DoD 4715.RR-M-1, DoD 4715.RR-M-2 and DoD 4715.RR-M-3[4]. Among other things, the plan should identify an appropriate analytical method that meets the required detection limits for the EC. In the event that the sample quantification limit (SQL) is insufficient to analyze at the anticipated levels of concern, other options such as analytic surrogates may be explored. If an analytical method with a sufficiently sensitive SQL is not available the issue generally should be brought to the attention of the DoD Environmental Data Quality Work Group for consultation with counterparts in regulatory agencies.

[4] DoD 4715.RR-M-1 "Department of Defense Quality Systems Manual for Environmental Laboratories," DoD 4715.RR-M-2, "Uniform Federal Policy for Implementing Environmental Quality Systems," DoD 4715.RR-M-3 "Uniform Federal Policy for Quality Assurance Project Plans.

3) All sources of toxicological and human health information should be searched to ascertain the best available science and identify uncertainties. This process is more fully described in the companion ECOS-DoD issue paper *Identification and Selection of Toxicity Values/Criteria for CERCLA and Hazardous Waste Site Risk Assessments in the Absence of IRIS Values.* In addition, if gaps in the human health science exist, recommendations should be made to states, EPA or other agencies for additional studies to reduce uncertainty.

4) Baseline risk assessments integrate the toxicological data with site-specific exposure factors and provide the basis for determining the extent of the risk and for taking any necessary response action. As discussed in the scenarios above, a range of response options typically can be considered to protect human health and the environment, as appropriate.

5) If agreement cannot be reached at the site level, the parties should consult with their respective organizations to determine an appropriate course of action. In such cases, the parties reserve all rights and authorities under existing law and regulations.

6) Even where agreement is not reached, the DoD component may want to consider risk management actions that would prevent, for example, further plume expansion, groundwater discharge to surface water and access to contaminated areas.

7) A working group of States, EPA and the DoD Environmental Data Quality Work Group should develop procedures and criteria for sampling ECs.

8) While the EC Task Group reached consensus on the above recommendations, the Task Group noted that implementation issues remain. Thus, all parties need to strive for consistent application within their organizations.